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ELECTRICAL WORLD

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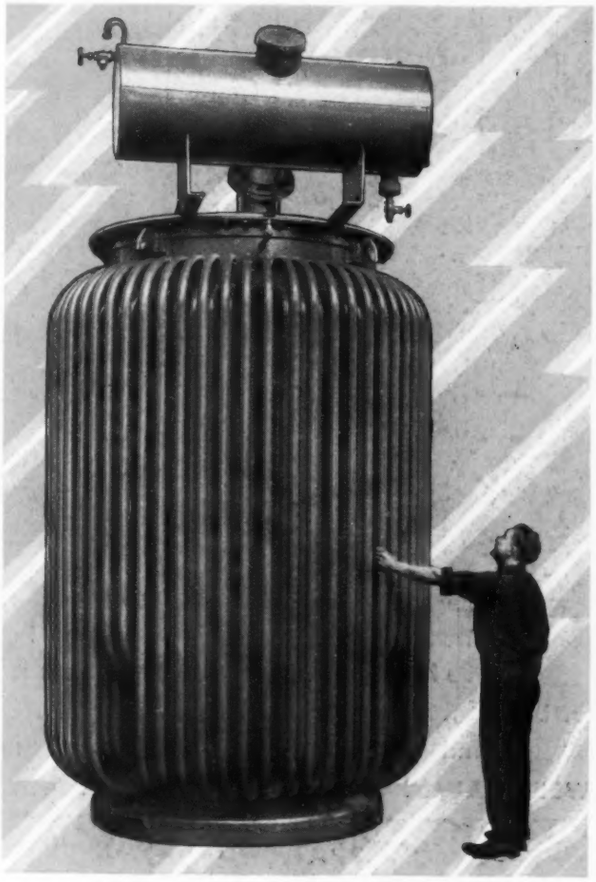

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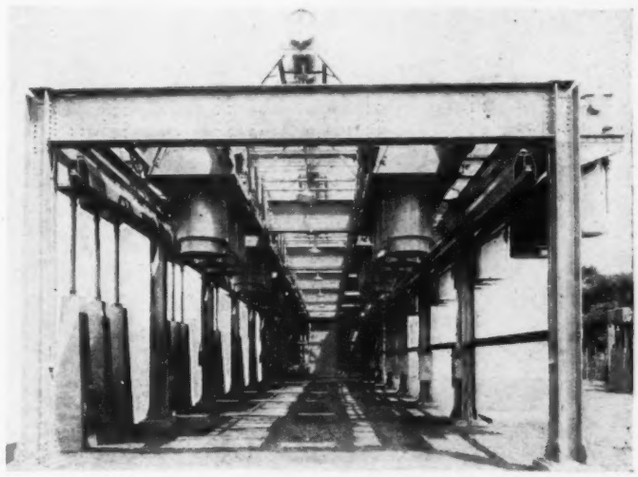

Metal-clad switchgear
Wheaton substation
Public Service Company
of Northern Illinois

OCTOBER 4, 1930

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ELECTRICAL WORLD

for the Week Ending

October 4, 1930

I have followed my bent and done the things I am here for, says **Elihu Thomson,** dean of General Electric's engineers and industry pioneer of 50 years' service, as national figures and 700 friends pay tribute; *I have known no greater joy than the joy of accomplishment.*

Another stock write-up charged at Federal Trade hearing

Water power and regulation to play part in New York State campaign

Power Commission's authority limited, decides Attorney-General

—FEDERAL TRADE investigation resumed, with Carolina Power & Light on the block. An alleged $19,000,000 write-up starts the fall work and provides newspaper copy.

—STOCK MARKET drags dispiritedly to lower price levels, approaching year's lows as public apathy and professional selling follow depression psychology. Midweek sees upward rally.

—SAN FRANCISCO supervisors, by majority vote, approve charter for three-man public utilities commission to operate municipal ventures. Members to be elected.

—NEW YORK gubernatorial conventions put utility business in both Republican and Democratic campaigns. Neither party finds situation satisfactory; both want reform—and lots of it.

—POWER BOARD authority limited as regards non-navigable waters, decides U. S. Attorney-General in response to demand of several states for ruling on scope of federal body.

—MINIATURE GOLF courses total 25,000. Engineer sees possible $10,000,000 equipment market and $10,000,000 yearly revenue for utilities. But how long will it last? Seasonal enthusiasms are not unheard of.

—NEW FINANCING up 50 per cent for year to date. September total 53 per cent over that of last year. Total for 1930 now $1,124,191,934.

NEWS OF THE WEEK

Industry Economics Absorb Convention of New England Division

NEED for effective control of the increasing investment to serve the public was the keynote of the twenty-second annual convention of the New England Division of the National Electric Light Association, which was held from Monday to Wednesday of this week at Swampscott, Mass. Load building along economic lines, improved public relations and broader engineering development were stressed in well-attended sessions.

President W. A. Jones of the national body pointed out that speed, size, change and mystery always attract public attention and that for this reason explanations of the industry's growth and objects should be given freely, presenting the facts in answer to the attacks of incompetent or selfish critics. Further, it must be impressed firmly upon the public mind that the cost of electric service is insignificant in comparison with that of many commonly used commodities. Mr. Jones declared that the public should be impressed with the truth that 70 per cent of utility business is competitive despite the fact that it is called a monopoly.

President C. H. Hodskinson of the New England Division termed the many false accusations hurled against the industry the most troublesome problem it has faced in years. Without dignifying scurrilous accusations by replies, he expressed the opinion that utility executives should not remain as quiescent as in the past on account of the danger that many thousands of investors, employees and customers may believe that there is some truth in these attacks.

L. L. Elden of the Boston Edison company presented at the commercial session a comprehensive analysis of rates for water heating, pointing out the importance of handling this business on an off-peak basis. The striking economic picture drawn by the author will be published in a later issue of the ELECTRICAL WORLD. Amos A. Winters of the New England Public Service Company presented an engineering paper on the equipment of the steamship *Jacona* for service in Maine as a 20,000-kw. floating power plant for use at different load centers, and Chairman A. D. Bailey of the Engineering National Section emphasized the value of engineering research, broader training for attacking increasing unit investment costs and a larger engineering outlook.

Miss Sarah Harding Hunter of Boston gave an address on the results of a survey of the purchase and use of electric appliances by utility employees and officials, revealing a startling lack of appreciation by some.

Advances in lighting, voltage variations in lamp service, accounting and Diesel engines also received attention at the convention; and H. T. Sands, vice-president Electric Bond & Share Compnay, gave a well-received talk on electrical development in South America. The convention closed with a women's session in which public and customer relations were stressed.

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North Carolina Case up at Trade Board Hearing

INFLATION of assets, failure to segregate such inflation from fixed-capital assets which are used for rate-making purposes and the lack of adequate retirement reserves for depreciation and obsolescence by the present Carolina Power & Light Company were disclosed

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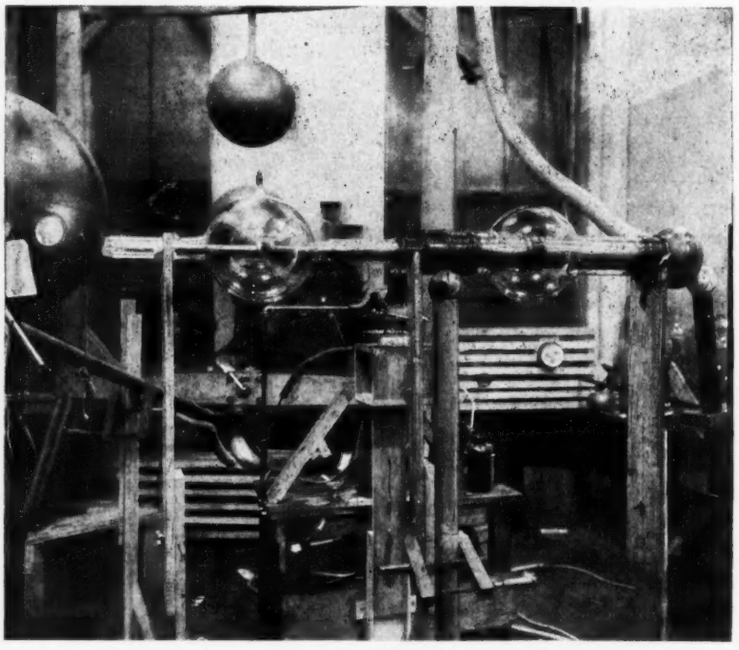
HALF-MILLION-VOLT X-RAYS NEXT



X-rays at 500,000 volts, more than twice as high a voltage as is being used in today's most powerful therapy tubes, have been attained by Dr. W. D. Coolidge, associate director of the General Electric research laboratory at Schenectady, by his new system of "cascading" the tube.

by their official researches, accountants for the Federal Trade Commission testified when that body reconvened at Washington on Monday, to pursue its investigation of public utilities.

The report of the accountants in this case was summarized in the ELECTRICAL WORLD for September 13 (page 462). Their testimony at the hearing will be printed in summarized form in an early issue. On Monday it concerned largely the $19,000,000 inflation of fixed capital that they see as the result of including at a "book value" of $400 a share stock carried at $100 by the old Carolina Power & Light Company before the merger of the Pigeon River Power Company in 1926.

Following the Carolina Power & Light Company examination the commission took up the case of the Minnesota Power & Light Company, also a "Bond & Share" property. Accountants charged a write-up in capital assets of more than $30,000,000. This case was continued on Wednesday, and another session was set for Thursday.

▼

Fifteen-Mile Falls "Goes in" Amid Cheers

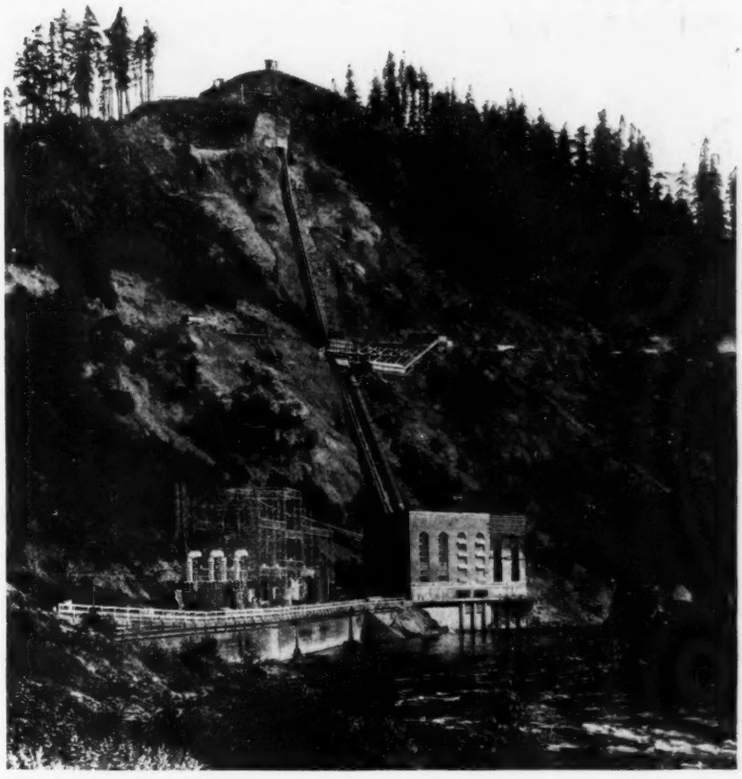
WITHOUT a hitch of any kind, the Fifteen-Mile Falls plant of the New England Power Association went into official service at 10.30 a.m. on Tuesday of this week in response to the closing of a key at the White House by President Hoover. About 300 guests, including many men of distinction in the fields of government, business and engineering, broke into rousing cheers.

Power immediately began to flow to the junction point with the rest of the system at Tewksbury, Mass., and on Wednesday the regular scheduled delivery of energy to the Boston Edison company at Woburn began according to the contract.

Congratulations were presented to President Comerford of the New England Power Association by Governor Tobey of New Hampshire, Governor Weeks of Vermont and Chairman Attwill of the Massachusetts Department of Public Utilities. In his address Mr. Comerford declared that the development evidenced the faith of investors and of utility men in the future of New England and pointed out that it would save about 200,000 tons of coal a year.

Many tributes were paid by the speakers and guests to the engineering and construction forces who put this 200,000-hp. development through ahead of time in a little more than two years of field work under varied and arduous conditions.

DOUBLING RATING OF OAK GROVE PLANT



Work is being rushed on the second 30,000-kw. unit of the Pacific Northwest Public Service Company's Oak Grove plant, and it is expected that it will be placed in operation by November. A new penstock now extends more than half way up the hill.

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Elihu Thomson Honored by Neighbors and Leaders

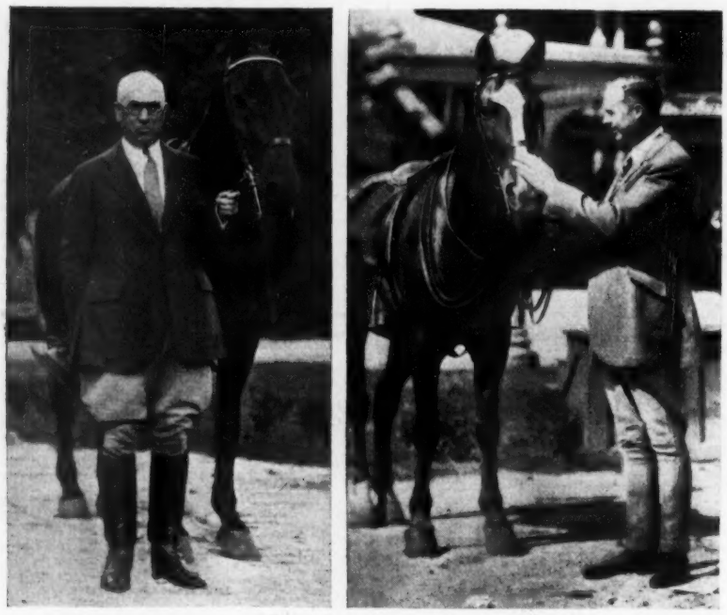
DECLARING that he was overwhelmed with praise and asserting that much of his life's happiness has resulted from following his natural bent in science and invention, Prof. Elihu Thomson was the modest recipient last Saturday evening of a flood of congratulations upon the completion of a half century of distinguished service to the electrical industry. A banquet in his honor at the New Ocean House, Swamscott, Mass., was attended by 700 neighbors and friends from Lynn and nearby points, and the scores of congratulatory telegrams received included messages from President Hoover, ex-President Coolidge, Thomas A. Edison, Governor Allen of Massachusetts, Owen D. Young, Gerard Swope, W. S. Lee, president A.I.E.E.; George K. Burgess, director Bureau of Standards, and many others. All paid tribute to the achievements of the dean of the General Electric Company's consulting engineers and research laboratory directors.

E. W. Rice, honorary chairman of the company's board and intimate associate of Dr. Thomson for many years in the pioneer development of the organization; Dr. S. W. Stratton, chairman of the corporation of the Massachusetts Institute of Technology, and President K. T. Compton of the institute spoke. Dr. Compton maintained that Dr. Thomson, more than any other man in history, has combined in a most remarkable way the constructive powers of the inventor, the thoroughness and soundness of the man of science and the kindly balance of the ideal philosopher, teacher and friend.

In his acknowledgment Dr. Thomson paid warm tribute to his associates in the early days of the embryo General Electric Company for their courage and foresight and stressed the importance to the man of science of contacts with and stimuli from other scientific men.

A solid silver platter was presented to the guest of honor. Dr. Thomson is now ardently engaged in the development of electrically fused quartz mirrors with the expectation of ultimately producing one 200 in. in diameter for the Mount Wilson Solar Observatory in California, to be used in the world's largest telescope.

N.E.L.A. OFFICERS QUALIFY AS EQUESTRIANS



President Jones (right) and Chairman Reed of the Public Relations National Section wisely mixed recreation with business at the French Lick convention of the Great Lakes Geographic Division last week.

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Great Lakes Division Meets at French Lick

INSISTENCE that the public should know that the electrical art is free, that the electric utility business is not a protected monopoly, that holding companies are useful agents of finance and management, that regulation and legislation are not the bases of growth of the industry but these bases are invention and business enterprise, and that the management of the utility business is, by the very fact of its success, in the hands of men of high integrity, was the burden of the address made by President W. A. Jones of the N.E.L.A. to the convention of the Great Lakes Division, held at French Lick, Ind., on Thursday to Saturday of last week.

Excellent talks by H. L. Russell, formerly a dean of the University of Wisconsin, and W. T. McCaskey of the Middle West Utilities Company declared agriculture not to be on the decline, but on the contrary rapidly improving its status both as an economic producer and as a manner of living. The ills of the farming industry will not be cured by government subvention and special treatment, but by the farmers themselves as they bring to their work good business sense and modern production facilities and methods. In these facts lie the motive and the promise for rural electric service.

Public relations, selling, regulation and government in business were other topics of the convention ably discussed by Harry Reid, chairman Public Relations National Section, N.E.L.A.; Henry Swift Ives, counsel for the Association of Casualty and Surety Executives, New York; James L. Madden, vice-president Metropolitan Life Insurance Company; W. L. Wilkie, counsel Commonwealth & Southern Corporation; W. H. Hodge, Byllesby vice-president; J. H. Foote of the Allied Engineers, and others.

▼

Export Tax Demanded on Alabama Energy

UTILITY and water-power issues are being raised in Alabama's political campaign. Senator Heflin, seeking re-election over the nominee of his party, John H. Bankhead, denounces his opponent as a friend and former attorney of the Alabama Power Company. More effectively perhaps, the Thompson newspapers are leading a fight to have the next Legislature limit the amount of hydro-electric power exported from the state and to put a special tax on all energy sent across the state line. In this connection they say: "Alabama now finds that approximately one-fourth of the hydro-electric power generated in the state is exported by the Alabama Power Company to its affiliated companies in neighboring states without a cent's return to Alabama."

Water Power and Regulation in New York Campaign

PARTISAN recrimination pervades the respective planks on water power and the regulation of utilities adopted this week by the Republican and Democratic parties in New York State, where St. Lawrence development and utility commission performance will—to how great an extent is not yet clear—figure in the November election. It is probable, however, that the voters, absorbed in questions that interest them more, will pay no great heed to these confused issues. Here are the planks:

REPUBLICAN

We promise a speedy solution of the problem of developing the water power resources of the state which shall be based on sound economic principles rather than on political expediency . . .

At the last session of the Legislature the Republican majority, on its own initiative, did what it could to take this vexatious question out of politics by authorizing the Governor to appoint a commission of his own selection to make a thorough study of any plans of water-power development that have been or may be proposed. . . . It is a matter of regret that the Governor by so long delaying its appointment should have caused the loss of half the time allowed.

Since March 1, 1927, the Public Service Commission has been controlled by the Democratic party. Since that time many questions relating to the control of public utility corporations, including the rates charged by these companies, have been dealt with by the commission in a manner which has tended to weaken public confidence.

With this fact in mind the Republican majority in the Legislature created a commission to revise the Public Service Commission law. Pursuant to the findings of this commission, the Legislature passed a series of bills at its last session designed to make more effective the state's control over the public utility companies.

Many of these bills were enacted into law, but some of the most important were vetoed by the Governor at the request of the corporations affected. The Republican party pledges itself to adjust the relations between the state and these great public utility corporations in accordance with the law of the land and for the best interest of the vast public of consumers.

DEMOCRATIC

Every consumer of electricity, gas or telephone service knows that the machinery for regulation of public utilities has failed. Bills introduced in 1930 by Democratic leaders in the Legislature to obtain lower rates and better service were defeated by the Republican majority.

Republican subservience to the huge public utility combines of the state prevented even a fair consideration of efforts at effective regulation. A completely new policy is necessary. We believe that:

Electrical energy should be developed by the state from its water-power resources in order to insure low-priced electricity.

Municipalities should be given the right to construct and operate public utility services upon the approval of the people within their borders, so that public competition may insure fair rates.

Interference by the federal courts with the regulatory powers of our Public Service Commission should cease.

The Public Service Commission should be an active, vigilant protector of public interests; its efforts should be directed toward obtaining fair rates and adequate service.

Legislation should be passed which will: (a) Prevent interminable litigation over valuations and accountings; (b) permit rate fixing by contract; (c) fix values for rates on investment basis; (d) prevent inordinate profits by manipulation of financial set-ups and security issues, and (e) effectively regulate and control holding corporations so that the consumer and the legitimate investor may be protected.

Court Alters Terms of Cordele (Ga.) Inquiry

HOLDING that the Georgia Public Service Commission had "concluded a question before it investigated it," Judge G. H. Howard of the Fulton County (Ga.) Superior Court issued an order on September 30 restraining the commission from forcing the Georgia Power Company to show cause why its general rates through territory served should not be reduced and made uniform with rates recently put in force in Cordele. Judge Howard, however, authorized a hearing by the commission of an inquiry to determine if the Georgia Power Company voluntarily cut its rates in Cordele and if the rates caused unjust discrimination against other cities of the state. Under Judge Howard's order, if the commission determines that the rates at Cordele were voluntarily cut and caused unjust discrimination against other cities, the commission is directed to proceed "according to law."

The Georgia Power Company recently cut its rates at Cordele 35 per cent "to meet unfair competition and protect its investment." This move was followed by an order from the Public Service Commission to the company to show cause why all of its rates should not be cut correspondingly. The power company field suit for an injunction.

Officials of the company claim a complete victory in the ruling of Judge Howard that the commission must make an investigation before issuing an order to show cause why rates should not be reduced. (See ELECTRICAL WORLD for August 30, page 379, and September 13, page 465.)

The Georgia Power Company has published a full-page advertisement in towns served by the company in which it gives fully its side of the case.

Certain interests in Georgia have endeavored to get the Federal Power Commission to take an interest in the dispute, proposing that Solicitor Charles A. Russell be sent to that state to look into it. The Federal Power Commission, however, despite political pressure, declared the matter entirely outside of its jurisdiction.

▼

American Electrochemical Society to Change Name

LAST week's fall convention of the American Electrochemical Society, held at Detroit from Thursday to Saturday, was the final meeting under the society's present name. In view of the large number of members from outside the United States, it has been determined to drop the first word, and after January 1 next the association will be known simply as the Electrochemical Society.

Electrochemical applications in the electromotive industry formed the subject of important papers and discussions. There were, as usual, many papers in the field of electrodeposition.

The outstanding feature of the meeting, however, was Dr. Richard Moldenke's paper on electric furnace gray iron. Read at luncheon on Friday, the informal discussion which followed it kept the delegates at the table till the afternoon was well advanced.

▼

Welding Society Hears About Methods of Testing

MEETING in Chicago last week simultaneously with several other societies called together by the American Society for Steel Treating in observance of "national metal week," the American Welding Society carried out at its separate sessions a program of a practical nature largely devoted to the progress being made in the testing of welds. Various methods were examined and discussed, such as by X-rays, by gamma rays and by bridging the seam with a large horseshoe electric magnet. A study of welded metals under fatigue test was summarized, and the cost of welding was gone into, the point being made that manufacturers of equipment, for example, would willingly pay more for welding of assured long life. Speakers discussed also tensile tests, bend tests and shear tests.

The electric arc welding of aluminum was declared practicable, within limits, as a production method, by W. M. Dunlap, and a paper by J. S. Adelson, E. O. Sequist and H. L. Whittemore on the physical properties of electrically welded tubing reported that investigation showed the strength of the weld in all cases to be virtually equal to the strength of the base metal.

▼

CLAUDE IN CUBA

—*Wide World Photos.*

Cool and collected, Georges Claude, French scientist, himself supervised the launching of his third power tube in Matanzas Bay, Cuba, whence it was towed to deeper waters.

▼

Safety Congress Hears 390 Special Speakers

ORGANIZED on the customary mammoth scale, the nineteenth annual safety congress of the National Safety Council was in session at two Pittsburgh hotels from Monday to Friday inclusive of this week. One hundred and forty sessions were addressed by about 390 special speakers. President C. E. Pettibone of Boston found encouragement in last year's record.

The Public Utilities Section, with which electrical interests are associated, held four sessions, including a joint one with the electric railway and other traffic divisions. A. J. Hill, Jr., of the West Penn Power Company and G. C. Neff of the Wisconsin Power & Light Company were among the participants in the program. The Duquesne Light Company of Pittsburgh won a certificate for having the best safety record among large electric power corporations.

E. S. Beaumont of Chicago was elected general chairman of the Public Utilities Section and John J. Barada of St. Louis secretary. Carl W. Bergquist of Chicago was named for president of the National Safety Council.

▼

Seven Sisters Transmission-Line Contract Let

CONTRACT has been let for the construction of a double-circuit, steel-tower high-tension transmission line from Seven Sisters Falls to Winnipeg. The Seven Sisters power site is being developed by the Northwestern Power Company, subsidiary of the Winnipeg Electric Company, and is designed for an ultimate capacity of 225,000 hp., against 96,000 hp., the pro-

jected ultimate installation at the city's Slave Falls plant. The transmission line will be built by the Canadian Engineering & Construction Company and is to be completed by next August at a cost of $1,000,000. Eventually, if present plans are carried out, a second line will be erected on the same right-of-way at an additional estimated cost of $750,000. The initial installation in the Seven Sisters power house is to consist of three units each of 37,500 hp., or half the designed capacity. These are expected to come into operation in 1931, operating under partial head and producing 40,000 hp.

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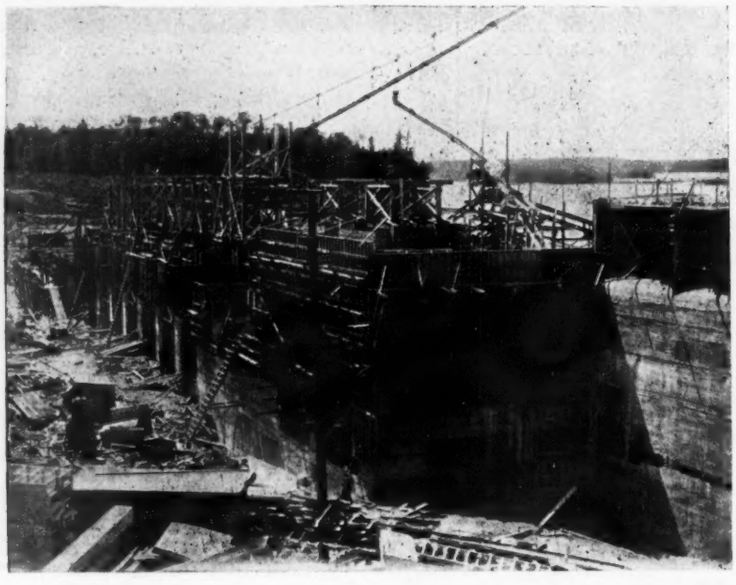
WINNIPEG'S NEW MUNICIPAL DEVELOPMENT



Rapid progress is being made on the Slave Falls hydro-electric development of the city of Winnipeg, Manitoba, for which the contract was awarded in June, 1929. The power station will contain eight 12,000-hp. units, two of which, composing the initial installation, are expected to go into operation a year hence.

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Oregon Judge Attacks Plan to End Commission

PERSISTENT agitation against the Oregon Public Service Commission and the pledge of Julius L. Meier, an independent candidate for Governor, to abolish the commission if he is elected have elicited from Judge James T. Brand of Marshfield a strong defense of the state regulating body in which he points out that its abolition would result both in an increase of the court congestion, already serious, and the setting up of numerous little municipal commissions, ill-paid and untrained. Judge Brand, whose arguments are applauded by H. H. Corey, the senior member of the commission, concludes by saying:

If public utilities privately owned are to exist at all—and no one suggests the contrary for the present—then they must be rigorously regulated for the public good or they will become our masters instead of our servants. If they are to be regulated effectively, it must be by one body, not by a hundred. To suggest local regulation by different municipalities of the same utility at the same time would present the impossible picture of a dozen dogs gnawing on the same bone.

I cannot believe that Oregon alone of all the sisterhood of states will now turn her back on administrative law just when the rest of the nation is beginning to appreciate its uses. The Public Service Commission is a necessity. The present system has its ills and must be cured, but no patient ever was cured by cutting out a vital organ.

▼

Western Inspectors Elect New Officers

OFFICERS were elected as follows at the recent meeting in Chicago of the Western Section of the International Association of Electrical Inspectors: President, A. G. Hall, Toronto; first vice-president, R. L. Daniel, Minneapolis; second vice-president, L. L. Johnson, Chicago; secretary-treasurer (re-elected), William S. Boyd, Chicago.

Philadelphia Prepares for Institute Meeting

FIVE technical sessions will afford a varied program on October 13, 14 and 15 to the Middle Eastern District meeting of the A.I.E.E. at Philadelphia. On Monday the morning session will be on communication, the afternoon session on hydro-electric power, and there will also be a conference of branch counselors and chairmen. On Tuesday electrical equipment and selected subjects will occupy the morning session, and transmission topics the afternoon, with luncheon meetings in between and banquet and entertainment in the evening. Railway electrification and electric traction will be the subject of the last session, on Wednesday morning, followed by inspection trips in the afternoon.

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Electric Rates Reduced in More Oklahoma Towns

VOLUNTARY reduction of electric rates in approximately forty cities and towns in the state has been announced by the Public Service Company of Oklahoma and approved by the Oklahoma Corporation Commission. The most recent reduction was announced for the Tulsa district, effective October 1, including Tulsa, Owasso, Inola, Catoosa, Carbondale, Red Fork, Garden City and Dawson. Lower rates were also announced for the McAlester district applying to nineteen towns and the Hugo district applying to twelve towns. In the Tulsa district rates were lowered one cent per kilowatt-hour on one or more of the steps of the domestic optional schedules. In the various towns in the McAlester and Hugo districts one cent was clipped from the top step of the rate in each case. As already reported (ELECTRICAL WORLD, September 20, page 511), the Oklahoma Gas & Electric Company has also made voluntary reductions affecting many towns.

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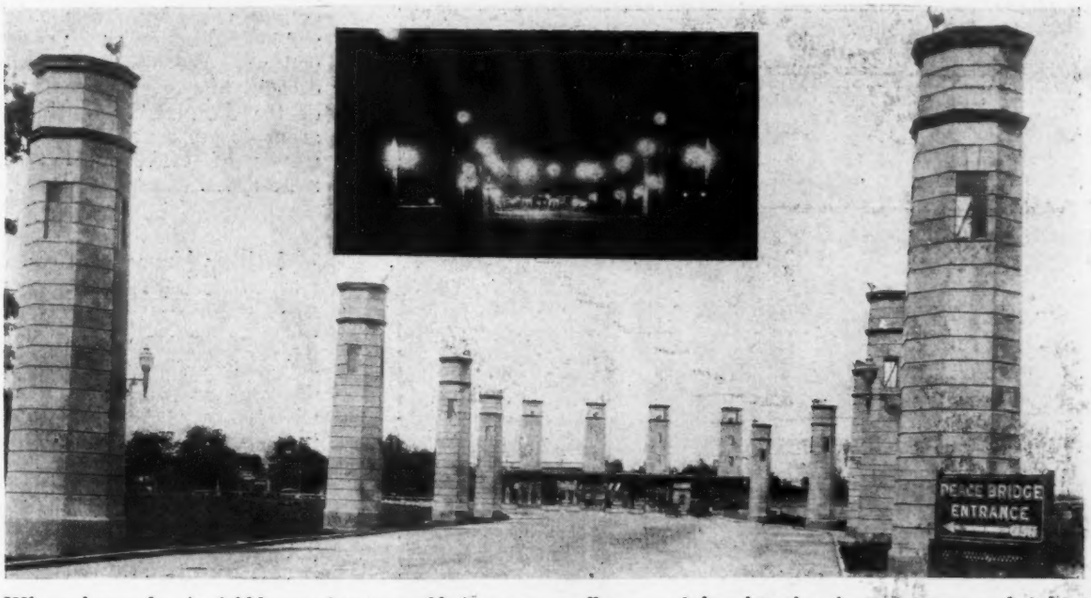
Sandstone Project Is Postponed for a Year

EXTENSION of one year in the time allowed the New-Kanawha Power Company for beginning construction work on a dam and hydro-electric plant at Sandstone, on the New River, was granted the company last week by the West Virginia Public Service Commission, which issued a license for this development a year ago. The New-Kanawha company is already constructing a dam, tunnel and electric plant at Hawk's Nest, on New River. The Sandstone project is separate.

LIGHT SPEEDS TRAFFIC ACROSS PEACE BRIDGE AT BUFFALO



Where formerly six 1,000-watt lamps enabled customs officers and immigration inspectors, crowded in a small area, to clear a maximum of 1,000 cars an hour seeking to cross the Niagara River on the Peace Bridge from the Canadian side to Buffalo, now a Westinghouse installation of 37 1,000-watt lamps illumines more than 100,000 sq.ft. and enables a possible clearance of twice as many. Day and night views are shown here.

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West Virginia Men Hear Leaders of Industry

ONE of the outstanding addresses at the thirteenth annual convention of the Public Utilities Association of West Virginia, held at White Sulphur Springs on September 23 and 24, was that of Harry Reid of New York, chairman of the Public Relations Section of the National Electric Light Association, on "Public Relations and Our Employees." Mr. Reid emphasized the necessity of the education of employees in relation to the economics of the industry as well as its technical side.

W. R. Voorhis, vice-president of the American Water Works & Electric Company, traced the growth of large holding companies with great diversity of interests and said that they were necessary to meet the needs of modern civilization, and C. S. MacCalla, vice-president Ohio Edison Company, an organization with a splendid record in accident prevention work, outlined the details of his company's safety policy and the returns received.

George M. Alexander, president Monongahela-West Penn Public Service Company, discussing business conditions, said that the utilities had a great opportunity as well as a great obligation in the present so-called business depression. Any business depression is perhaps 90 per cent psychological and 10 per cent actual, he believed. Through a survey made of business conditions in the territory covered by his company, he had found business in many cases better than a year ago and in a great many cases better than two years ago.

Officers were elected as follows: President, C. H. Hardesty, vice-president Monongahela-West Penn Public Service Company, Fairmont; vice-presidents, H. M. Cogan, John B. Garden and H. E. Watt; secretary (re-elected), A. Bliss McCrum.

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Bids Sought in Seattle for Diablo Power House

BIDS for construction of the Diablo power house, next step in the development of Seattle's Skagit hydroelectric project, will be called for soon, and it is planned to award contract about December 1, according to R. H. Thomson, city engineer. Mr. Thomson says that the power house will probably be constructed by steps, and it will require eighteen months to complete the plant. Contracts for the machinery have been awarded.

The City Council has before it now the question of appropriating an additional $25,000 for preliminary survey in the Ruby Creek basin on the upper Skagit River, in preparation for the construction of another dam.

Coal Surcharge Delays New York Edison Hearings

DELAY again protracted the commission hearings on the proposed new rates of the New York Edison and its allied companies on September 25 and 26. Cross-examinations of witnesses by E. F. Jeffe, an engineer who is protesting against the retained coal surcharges to industrial consumers; Dr. John Bauer, utility rate expert, and others prevented the proceedings from reaching the point where President M. S. Sloan could appropriately be called upon to testify on the broader matters of policy. Chairman Maltbie said the coal surcharges would be taken into consideration in fixing the rates.

On Tuesday of this week the charge of a dollar a month per kilowatt of maximum demand that commercial customers using less than 5,000 kw.-hr. a month will be asked to pay in addition to the 60-cent monthly meter charge came up for notice. Chairman Maltbie, dwelling on testimony that border-line consumers would sometimes have to choose between this classification and existing commercial rate schedules, implied that, in his opinion, the tariff would become unnecessarily complicated and that unfair discriminations might result. He suggested that a greater degree of simplification was possible.

FLOODLIGHTING SPREADS IN ENGLAND

—*Wide World Photos*

This effective illumination of University Tower, Bristol, shows how floodlighting has come into vogue in Great Britain in recent months.

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Safe Harbor Turbines Now Under Contract

CONTRACT has been placed by the Safe Harbor Water Power Corporation for six hydraulic turbines, each with a rated capacity of 42,500 hp. under a 55-ft. gross head, for the new development which the Aldred interests are building on the Susquehanna, 8 miles above their Holtwood plant. Besides this initial installation of 255,000 hp., provision is being made in the foundation of the power house for six more turbines, which will make the ultimate capacity of the development more than 500,000 hp. These turbines will all be of the Kaplan propeller type with automatically adjusted blades. These blades are shaped somewhat like those of a ship's propeller, but the angle of the blades will be changed as the hydraulic conditions and the load on the turbine change. The turbines will be, the engineers say, the most powerful of that type in the world and among the largest-diameter wheels of any type in the United States.

Three of the turbines will be made by the S. Morgan Smith Company of York, Pa., and three by I. P. Morris & De La Vergne, Inc., of Philadelphia, but all will be of the same design so that substantially all parts will be interchangeable. The water passages from intake at racks to discharge of draft tubes will also be of the same design. This unusual arrangement was made possible by the co-operation of the engineers of the manufacturing companies and the power company and as a result of research work carried out by these engineers at the manufacturers' laboratories and the new hydraulic testing laboratory erected by the Aldred interests at Holtwood and described on this page.

For this new type of turbine a number of advantages are claimed, among which are cited greater speed, resulting in lower cost of electrical generator; greater efficiency under varying load and hydraulic conditions; greater power under reduced head, and much greater capacity in a given space. The capacity of the Safe Harbor turbines will be about 40 per cent greater than that of wheels of conventional type in the same space.

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Utility Happenings Affect Ohio Cities

FORMATION of the Central Ohio Power & Light Company at Findlay through the merger of five northern Ohio power and light companies and the power and light holdings of the Western Ohio Railway & Power Company and the Toledo, Bowling Green & Southern Traction Company has been approved by the Public Utilities Commission of the state. (See ELECTRICAL WORLD for September 13, page 464.)

Petitions for a referendum in November on a proposal to bond the city of Sandusky for municipal light plant purposes have been presented to the election board by the Municipal Light Plant Association. The Ohio Public Service Company is expected to seek to prevent the proposal going on the ballot, as it succeeded in doing a year ago.

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High-Head Laboratory for Safe Harbor Models

IN THE interest of the 500,000-hp. Safe Harbor hydro development on the Susquehanna, which the Aldred interests are pushing through the initial stages of construction, a hydraulic test laboratory has been built at the associated Holtwood plant on the same river by Pennsylvania Water & Power Company engineeers. This laboratory is so designed that models of the exact intake passages and draft-tube or discharge passages to be used with the model turbines can be tested as a complete unit, thus permitting the power corporation's engineers to predict accurately the performance and behavior of the actual equipment when installed at the Safe Harbor power plant.

The Holtwood laboratory is one of the first hydraulic laboratories to be built in this country for testing turbines under the actual head existing in the field, though low-head laboratories are not uncommon. Exact models of the waterwheels proposed for use at Safe Harbor have been undergoing test. The model wheels are 16 in. in diameter, this being about one-fourteenth the size of the actual wheels to be installed at Safe Harbor.

Coming Meetings

Illuminating Engineering Society—Hotel John Marshall, Richmond, Va., Oct. 7-10. E. H. Hobbie, 29 West 39th St., New York.

Empire State Gas and Electric Association—Meter Section, Watertown, N. Y., Oct. 9 and 10. C. H. B. Chapin, Grand Central Terminal, New York.

Public Utilities Advertising Association—Atlantic City, Oct. 10 and 11. J. R. Pershall, 72 West Adams St., Chicago.

American Institute of Electrical Engineers—Middle Eastern District, Philadelphia, Oct. 13-15; Southern District, Louisville, Nov. 19-22. F. L. Hutchinson, 33 West 39th St., New York.

American Engineering Council—Administrative Board, Mayflower Hotel, Washington, Oct. 17 and 18. L. W. Wallace, 26 Jackson Place, Washington.

Rocky Mountain Division, N.E.L.A.—Franciscan Hotel, Albuquerque, N. M., Oct. 20-22. O. H. Weller, Public Service Co. of Colorado, Denver.

National Electrical Manufacturers' Association—Chamberlain-Vanderbilt Hotel, Old Point Comfort, Va., Oct. 20-24. A. W. Berresford, 420 Lexington Ave., New York.

National Electrical Wholesalers' Association—Pittsburgh, Nov. 10-14. E. Donald Tolles, 165 Broadway, New York.

National Association of Railroad and Utilities Commissioners—Charleston, S. C., Nov. 12-15. J. B. Walker, 270 Madison Ave., New York.

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Attorney-General Passes Upon Power Board Issue

IT WAS announced by the Federal Power Commission on September 26 that an opinion from the Attorney-General regarding the responsibility placed upon the commission under certain provisions of the federal water-power act relating to projects on non-navigable streams had been received. The question at issue was the extent of the responsibility of the commission in issuing licenses for water-power projects within the several states and located on non-navigable tributaries of navigable waters where no government lands or reservations are involved.

It has been the past practice of the commission, whenever the operation of a project on a non-navigable tributary would so affect the flow of the navigable waterway into which such tributary emptied as to impair its navigable capacity and therefore affect the interests of interstate or foreign commerce, to include in the license for the project all the conditions of the act applicable to projects in navigable waters of the United States.

Certain states held that this practice exceeded the authority of the federal government and that the latter is limited to imposing only such conditions as may be necessary to maintain unimpaired the navigable capacity of the navigable water into which a tributary empties. The objections raised by these states, particularly West Virginia, Tennessee and Virginia, were presented to the Attorney-General. The purport of his finding is that the commission is not required to insert in a license any conditions (except the 50-year limitation upon the terms of the license) which, in its judgment, are not necessary or appropriate fully to utilize the waters of the tributary in the protection or development of navigation on the navigable waters into which such tributary empties.

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For a San Francisco Utilities Commission

BY A VOTE of eleven to five the San Francisco Board of Supervisors has approved a charter amendment to set up a public utilities commission for the city. This commission is to consist of three members, each holding office for six years after the first terms, which shall be two, four and six years respectively. The first members are to be appointed by the Mayor, their successors elected. Salaries are fixed at $6,000.

The commission is to appoint a Californian as manager of utilities and to make monthly appropriations for their conduct. If the surplus in any year exceeds 25 per cent of the operating expenses, the surplus may revert to the general fund, but this is not compulsory.

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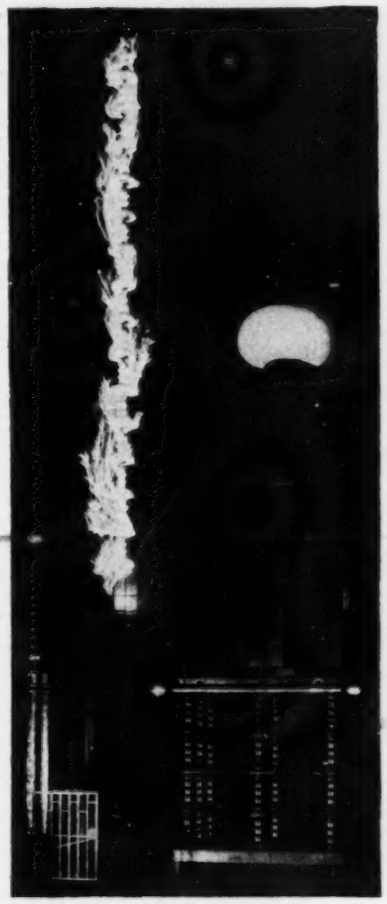
Suburban Light & Power Goes Into Receivership

CONFESSION of judgment for $1,076,800 in a pending lawsuit has brought about the appointment of Joseph C. Fogg, Cleveland, as receiver for the Suburban Light & Power Company, whose principal offices are at Alliance, Ohio. The judgment and receivership were understood to be further steps in adjustment of the involved financial affairs of the Suburban company and of the Utilities Service Company, also of Alliance, which went into receivership on September 18. The Suburban receivership suit was brought for the Chase National Bank of New York, which made large loans to the Suburban company and the Utilities Service Company while the latter were carrying on an extensive expansion program.

The Suburban Light & Power Company, with two subsidiaries named in the suit, has about 11,000 customers for electric light and power in 100 or more Ohio cities and towns, including Canton, Youngstown, Marion, Newark, Columbus and Lima.

LABORATORY WORK IN RUSSIA



***This 15-ft. chain of insulators is** undergoing a million-volt test at the Siemens-Schuckert transformer works at Nuremberg, Germany. It was made for the All-Russian electrotechnical experimental laboratory at Moscow.*

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Electrical Insulation Committee Meets Nov. 7

THREE technical sessions of the committee on electrical insulation of the division of engineering and industrial research of the National Research Council will be held at the Bureau of Standards, Washington, on November 7 and 8. This will be the committee's regular annual two-day meeting and conference. Eighteen informal papers reporting current progress in dielectric and insulation research will be presented, and an illustrated lecture by a prominent physicist will follow a subscription dinner.

Dr. J. B. Whitehead of Johns Hopkins is chairman of the committee on electrical insulation.

Edison Lamp Works—National Lamp Works

Demonstrate Value of Light

IN NEARLY every factory will be found some operations which are inadequately illuminated because some one tried to utilize the same arrangement and type of units throughout the plant without regard to sectional or individual requirements. As a result quality and speed of work have suffered in these sections and the unit fixed and operating charges assessable to operations performed there are unnecessarily high.

If proper illumination of the operations which are hampered most by inadequate lighting is tackled and solved first, sufficient improvement in operating results may be demonstrated to interest the management in more extensive rehabilitation of lighting.

EDITORIALS

L.W.W.MORROW
Editor

Investors may shatter utility silences

TOO little information and not the right kind —this was the burden of the charge which George Clarke Cox, investment counsel, brought against the utility companies at the recent meeting of the Empire State Gas and Electric Association as he pointed to financial statements which state little or nothing and reports which report nothing. Even an experienced and seasoned investment banker cannot squeeze them to the point of yielding the factual information needed by a judicious security purchaser in forming an intelligent opinion, Dr. Cox contends, and accounting practices are effectively devised to bring out none of the facts in valuation controversies. It will all change, though, warns Dr. Cox, who sees the investor as the Nemesis of secrecy.

There is far more than "just another crack at the utilities" in these charges. There is simple elementary truth. Operating and, particularly, holding company reports should be made models of accounting clarity. After all, these are the facts that the public really wants—"the facts about our business."

Constructively, it may be urged that financial statements be clear, frequent and revealing; that accounting practices be comparable; that reports be more factual; that management fees and services be shown, and that balance sheets be itemized sufficiently.

There is, in spite of publicity efforts, public educational activities, public relations policies and the improved annual reports of many utilities, still mystery in the utility business. As Dr. Cox contends, even were there no other interested parties, the investor alone would turn the tide toward more detailed and clear annual reports. In the purchases of securities lies the hope of financing growth. Billions will be needed to expand the business. Facts and conservative judgment will guide the security buying of tomorrow and establish the credit for the security issues.

The Dill bill should not pass

WHAT is interpreted in industrial circles as the most dangerous attack on the patent system yet proposed is embodied in Senator Dill's bill "against trust-owned patents." The measure was passed by the Senate at the last session, was recalled from the House and will be taken up again in the December session of Congress. The fate of this measure is of the utmost importance to the electrical industry, whose progress is so dependent upon the proper development, application and protection of patents.

An amazing departure in court procedure is suggested by this remarkable bill, which provides that the defendant in a patent infringement suit may interpose as a complete defense proof that the plaintiff is violating any one of the anti-trust laws. Defense, in brief, is constituted in countercharge. The accused is allowed to defend himself by accusing his accuser of some other offense.

Opponents of the measure assert that it invites unending litigation and suggests blackmail on an extensive scale. When one is charged with infringing patents he may contend that the owner of the patent is violating the anti-trust statutes, and this contention would permit infringement to continue while the charge was being passed on by the judiciary. The anti-trust case must be tried in advance of the patent infringement case. Such a statute would conceivably permit the unscrupulous to obtain compromises from those who could not afford to have the validity of their patent called into question.

While the dangerous possibilities of such a bill are well understood, an active campaign is being waged in its support. This suggests the urgency of organized opposition to its passage. It is now opposed by such organizations as the American Patent Law Association, the patent section of the American Bar Association, the National Electrical Manufacturers' Association and by other organizations capable of appreciating its pernicious potentialities. There is little enough protection for the inventor in our patent laws now; he seldom profits financially, only acquiring a right to litigation. Nothing should be left undone to assure the defeat of this bill.

Call it a subsidy or a compromise

MORE and more it is evident that some aspects of the relations of the utilities with their public are flavored with questions of policy that involve the element of subsidy or economic charity. The case of the rural electric customer and that of the small residential customer in the city are both instances where the failure to be self-sustaining is partially excused on the ground that the general good of the whole electric public demands such a compromise. The validity of that excuse has hardly been fully established as a matter of broad policy.

Meanwhile the impression that electric rates and extension charges are intricate largely because they are intended to be economically precise conflicts with an equal impression that they are not precise because a compensatory rate for each class would throttle the industry. The invested dollars per dollar of revenue are still increasing, and much of the increase is attributed to the generous policy of extension into rural and other lean territory. It may be several years before the revenue from such users will provide a return on the added capital. Whether the practice is a matter of expediency or of far-seeing policy is not always clear. Likewise, the advocacy of the service charge for small residential customers is usually accompanied by the assertion that the figure of 50 or 75 cents is nominal and not enough to cover fully what it is intended to embrace.

The electric power industry makes claim to an outstanding position in the field of public service because it provides a *sine qua non* for productive efficiency and domestic comfort. The most significant source of the public hesitancy to grant the claim at its full value lies in part in the lack of appreciation of the potentiality of electric service and in part in inability to grasp the intricacies of the rates for the service. Sooner or later the time will arrive when it will be advantageous to indicate in fuller measure how much of the complexity of rates is due to an effort at precise equity and how much their approximate equity is dictated by considerations of communal averaging. If kilowatt-hours are to be subsidized like postage stamps, rural telephones and subway fares, the industry should get the credit for the sociality of its charges; otherwise it should stand firmly by the decision to ask each class of consumers to pay its own way.

Elihu Thomson honored

LAST Saturday Elihu Thomson was the recipient of congratulations upon the completion of fifty years of service to the electrical industry. President Hoover, Thomas A. Edison, E. W. Rice, ex-President Coolidge, Owen D. Young and a host of other prominent Americans showered the distinguished scientist with felicitations and good wishes.

The career of Elihu Thomson is a shining example of modesty, perseverance and courage. Inventor, educator, scientist and inspirer, he has contributed very greatly to the development of electrical engineering and electrical apparatus. He is the father of the research laboratory. He followed his liking for research despite the temptations of commercial affairs and is happy today, as yesterday, in trying to apply new knowledge and bring new contributions to art and science.

All electrical men can agree with President Compton that Dr. Thomson, more than any other man in history, has combined in a most remarkable way the constructive powers of the inventor, the thoroughness and soundness of the scientist and the kindly balance of the ideal philosopher, teacher and friend. He deserves all the honor the industry can bestow upon him.

Increasing the strength of air gaps

THE value of internal barriers in oil-filled terminals and bushings for increasing the breakdown voltage has long been recognized and utilized. However, the amount of increase in relation to the dimensions and properties of the barriers has not been susceptible to engineering design. The increase is not due to the dielectric strength of the barriers alone, but also to their influence in breaking up incipient ionization or other conducting paths in the oil.

Much new light has been thrown on this question by the many recent studies of the initial stages of spark discharge in air. These studies have revealed the important consequences of the very great difference in the velocities of electrons and of positive ions arising from the process of ionization. With a pointed positive and an extended negative, electrode ionization starts with the inrush of the high-speed negative electrons to the positive point. The sluggish positive ions so created move very slowly, so that they form a space charge which increases the field toward the negative electrode; that is, automatically tend to bring new regions into the zone of ionization. The result is a series of luminous canals of inrushing electrons to the positive point, each with its many branches reaching out to a border-line region of initial ionization and forming the well-known spark pattern around a positive point. The space charge works in opposite manner for a negative point, and this arrangement gives about two and one-half times the breakdown strength as compared with opposite polarity. However—and this is the important point—the breakdown value with point positive can be raised almost to the same value as with point negative by interposing a screen suitable in thickness and position between the electrodes. The screen breaks up the extension of the positive space charge and resulting electron canals toward the negative electrode.

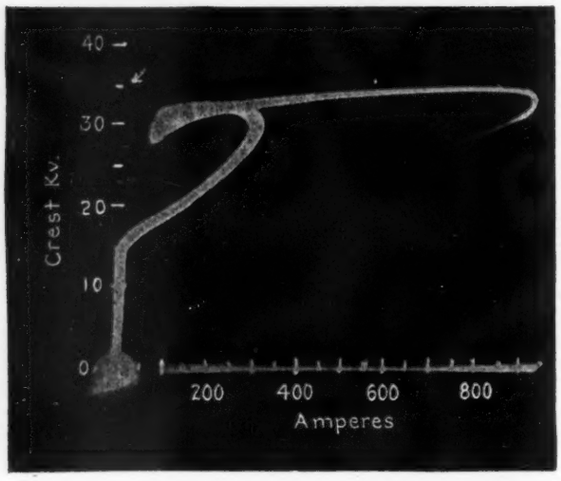
Experimental studies of the influence of this theory on a number of forms of discharge path as found in practice are reported by E. Marx in a recent number of the *Archiv für Elektrotechnik*. Continuous and impulse voltages for a given gap and polarity give the same breakdown values, the entire phenomenon being very rapid owing to the high absolute velocities of the electrons and positive ions. Alternating voltage reverses the polarity, and the breakdown in the case of unsymmetrical electrodes, as, for example, a string of insulators, occurs first on only one-half wave, and on the other half wave only at a higher value. A suitable use of screens or a decrease in curvature of one or the other electrode will bring the breakdown on each half wave to the same value, increasing the final breakdown value of the gap. The phenomena are not so clear-cut in the case of insulating liquids, owing doubtless to the greater complexity of ionic movement. But here, too, it is known that space charge plays a part, and more exact knowledge with resulting improvements and economies in design must follow soon.

Commercial lightning tests on transformers

ANOTHER encouraging step in solving the lightning problem has been made. Lightning tests have been applied to commercial transformers at the factory before shipment. Although lightning investigations have been conducted on a grand scale by manufacturers and operating companies for several years, few utility engineers had any hope that commercial transformers would be subjected to such tests at the factory so soon. The tests were conducted on 13,000-kva. transformers immediately after the regular commercial tests were completed. Transmission-line operating conditions were reproduced, and the equipment was subjected to 3,000,000-volt surges with one-half microsecond wave fronts and 80-microsecond tested tails. It is reported that it was impossible to break down the transformers tested under such impulses.

If these tests are followed by others, as no doubt they will be, they should assist in the attempt to establish definite specifications for protecting transformers against lightning. Whether or not it will be possible or economical in the near future to conduct such tests on all large transformers only time can tell. But F. W. Peek, Jr., who conducted these tests, is again to be congratulated upon applying the results of a great amount of theoretical and laboratory investigation to a definite case by a commercial test.

Efficacy of Lightning Arresters —Line Type



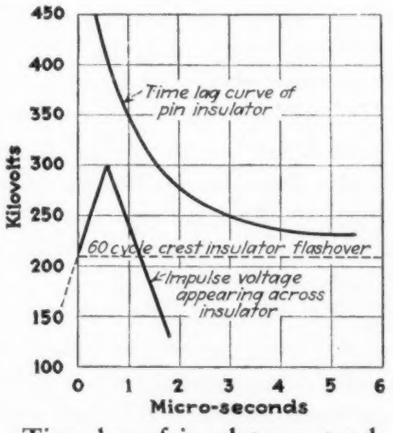
Uniform voltage cutoff for wide range of discharge current

THE use of lightning arresters along high-voltage lines has in the past appeared hardly feasible, except in very special cases, because of the large size and weight of the commercially available arresters, necessitating rather spacious and expensive methods of installation. Recent developments of arrester types which compare favorably in size with the insulator strings generally used have given this idea new impetus, and as a part of the lightning research program of the company with which the authors are associated, and with the co-operation of various operating companies, several installations of line type arresters have been made on 22-, 66- and 110-kv. lines in order to investigate the possibilities of this project. The first of these installations was made in 1927 on a 22-kv. line, using special autovalve arresters. Although in this case they were not spaced uniformly over the line, but were located at what were considered exposed points, the years of experience on this line have yielded some interesting data.

In 1929 additional trial installations were made, using the confined discharge or porous block type of autovalve arrester described before the A.I.E.E. during the winter of 1929-1930.[1] [2] The majority of these were in service for the 1929 lightning season.

Two advantages in the use of distributed line arresters can be visualized. One is the reduction of flashover of insulators and the second is a reduction of the burden on station arresters, which might result in the ultimate elimination of the station type arrester now in general use, perhaps substituting for it one or several line type arresters with consequent reduction in space requirements and installation cost.

The problem of protecting an entire line against lightning flashover is a more difficult one to solve than the station question. In a station the arrester is called upon to protect only insulation close to the arrester location, and generally behind the arrester in relation to the direction from which the surge arrives. On a line, unless arresters are to be installed at every insulator, they must also provide protection for some distance in the direction of the origin of the surge. Since the arrester will protect all insulator strings beyond it, provided its ground resistance is low and that possible reflections from a line terminus are prevented, the whole problem revolves about the zone of protection which the arrester provides in the direction from which the surge approaches. This zone depends on three quantities—the rate of rise of voltage of the surge front, the impulse flashover characteristic of the line insulation, and the voltage to which the arrester limits the surge. The less the rate of rise of surge voltage, or the greater the margin between the flashover of the line insulation and the arrester voltage, the greater will be the zone of protection.



Time lag of insulator extends spacing to 1,160 ft.

Data on the impulse performance of line insulation are available,[3] and the performance of the arresters can be determined by cathode-ray oscillograph tests. The third quantity, the rate of rise of the lightning transient voltage, is not yet definitely known for all cases. However, the numerous oscillographic records of lightning surges that have been secured during the past

[1] *Slepian, Tanberg and Krause, "Theory of a New Valve Type Lightning Arrester," Transactions A.I.E.E., Vol. 19, No. 1, page 257.*

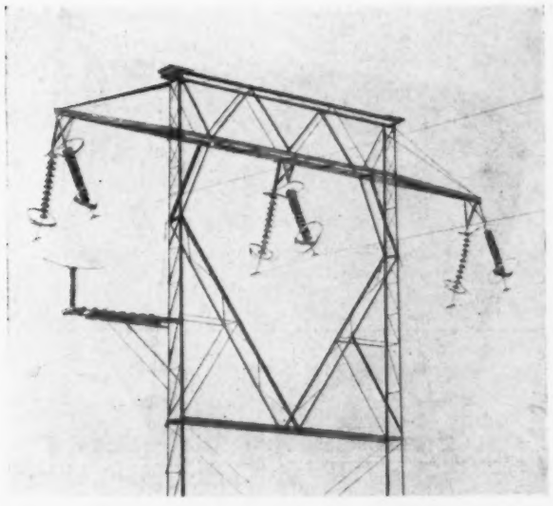
[2] *Slepian, Tanberg and Krause, "Development of the New Autovalve Arrester," Transactions A.I.E.E., Vol. 49, No. 2, page 404.*

[3] *Lightning Symposium, Transactions A.I.E.E., Vol. 49, No. 3.*

[4] *C. L. Fortescue, "Rationalization of Station Insulating Structure," presented at summer, 1930, convention of A.I.E.E.*

By
EDWARD BECK
C. L. JONES
A. M. OPSAHL

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.



Installation on 110-kv. line where open gap arrester is mounted on a bracket

two years[3] furnish a basis on which to work. Although incomplete, it is the best data available from actual experience and, in the light of the field trials with distributed arresters, does not appear to be far wrong. With these three quantities fixed, it is readily possible to calculate the zone of protection of the arresters used on a line of given insulation, and thus to determine the minimum spacing required between arresters if flashovers are to be prevented.

Let us investigate the effect of an arrester which is a voltage-limiting device and does not partake of the nature of a resistance, but having the characteristic shown in the oscillogram, on a traveling wave approaching it over the line. As shown in the voltage distribution diagram (see page 638) the incident wave e_i is limited by the arrester to the value e_a. The arrester sends back a reverse voltage $e_r = e_a - e_i$, so the resultant configuration of voltage at an instant is shown by the solid line. At the point p the voltage rises uniformly as the wave passes by at N kv. per microsecond. After the reflected wave e_r reaches p the voltage at this point remains constant, as it is the difference of two voltages rising at the same rate. This constant voltage is represented by

$$e_p = e_a + Nd \times 2 \quad (1)$$

where

N = slope of the front in kilovolts per microsecond.

d = distance in thousands of feet.

This relation holds as long as the front of the wave is rising uniformly. As the slope becomes less and the crest of the wave reaches p the voltage e_p drops.

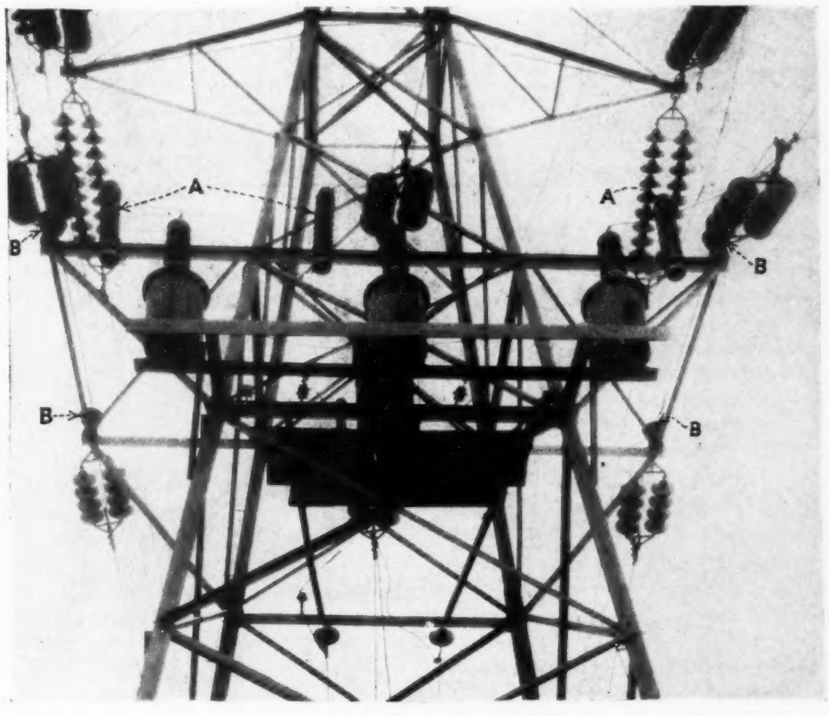
The arrester current at any instant is:

$$i_a = \frac{2e_i - 2e_a}{Z} \quad (2)$$

where e_i = the incident voltage that would have appeared at this time at the arrester location if the arrester were not there.

Z = surge impedance of the line, about 500 ohms.

In case there is considerable resistance, R, in the arrester ground, the voltage existing from line to earth at



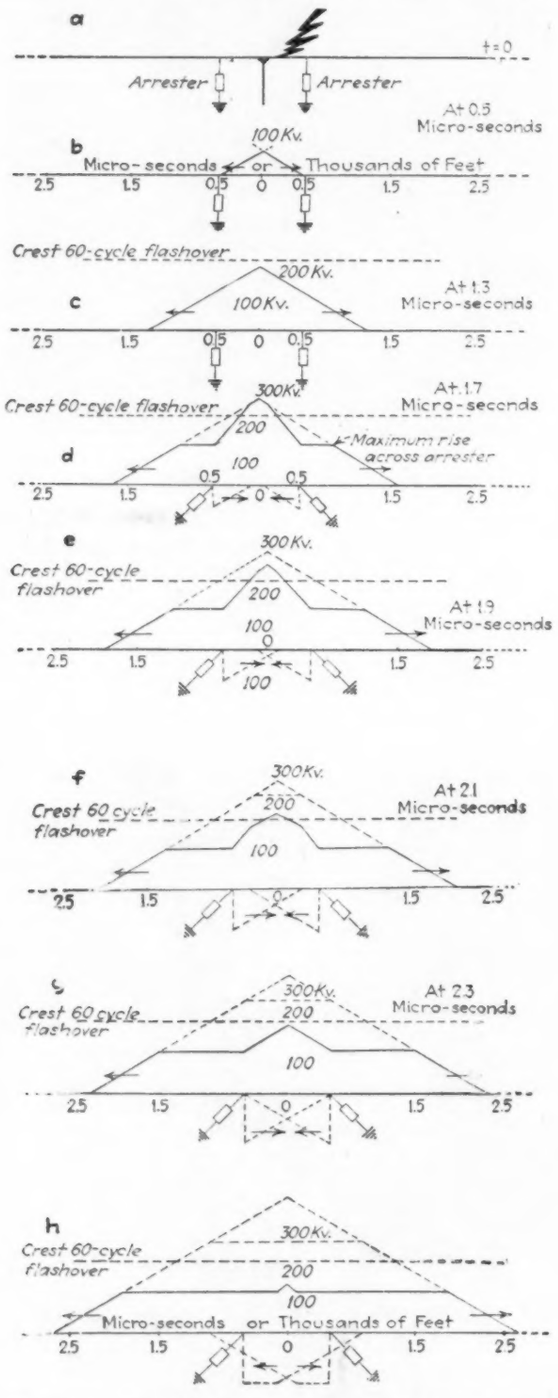
Installation of special disk type autovalve arresters on a 25-kv. line

On same towers with and under two 132-kv. circuits. A—Arresters. B—Pin insulators which determine flashover of 25-kv. line.

the arrester location is increased above e_a by the IR drop in the ground. Hence a correction must be added to (1) and the voltage at p is:

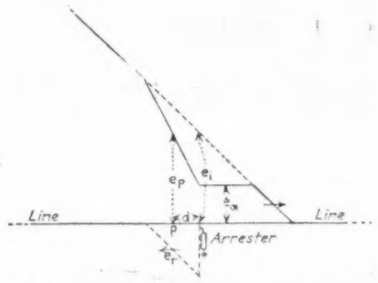
$$e_p = \left[e_a + (e_i - e_a) \frac{2R}{Z + 2R} \right] + \left(1 + \frac{Z}{Z + 2R} \right) Nd \qquad (3)$$

The voltage at p in this case depends on the maximum voltage that would have appeared on the line. In (1) that complication does not enter in and the voltage at p is lower. This indicates the importance of a low arrester ground resistance in the protection of adjacent towers.



Spacing of 560 ft. appropriate if time lag of pin insulators on 33-kv. line is ignored

Although probably no measurements of a lightning wave have been made at the point of origin, yet there is sufficient data to indicate that the wave front is as steep as 150 kv. per microsecond, and slower but probably not much steeper.



Voltage distribution of surge in vicinity of arrester

A representative step - by - step development of the effect of two arresters on a surge of this front originating midway between them is shown in an accompanying illustration. The arrester ground resistance is assumed low enough to be neglected. From this we see that the voltage e_p rises at a uniform rate of 150 kv. per microsecond to

$$e_p \text{ max.} = e_a + 2 \times 150 \times d \qquad (4)$$

and then, as the reflected waves from the arresters reach this point, falls at a uniform rate of 150 kv. per microsecond. The dotted lines indicate the incident and reflected waves. The full line indicates the resultant voltage configuration at that instant. A microsecond in time corresponds to 1,000 ft. of overhead conductor for a traveling wave.

The result on a 33-kv. line

Applying these calculations to a 33-kv. wood pole line, for instance, if it is desired to limit the voltage to the 60-cycle crest flashover of pin insulators such as might be used, assumed 210-kv. crest, the allowable space between arresters is 560 ft.

Taking into account the time lag characteristics of the insulator as shown in the accompanying illustration, the maximum value of the voltage that appears between the arresters which the insulator is likely to stand without flashover is shown by the triangular wave of 300-kv. crest. This gives an arrester spacing of 1,160 feet.

Taking advantage of the additional insulation of the wood poles by adequately insulating the guys, if present, to increase the 60-cycle crest flashover to say 410-kv. crest, the spacing would be 1,900 feet, or taking the time lag of the insulation into account, 2,960 feet maximum spacing between arresters should protect against line-to-ground flashover.

From this it can be seen how the margin between line flashover and voltage across the arrester influences the arrester spacing, and from equation (3) the increase in protected zone with decreasing wave front rate of rise is apparent.

At the time the first field installations were made the lightning investigations in the field had not provided sufficient data on the nature of the lightning disturbances which occur on transmission lines to determine the proper spacing of arresters. Therefore, in these installations, the spacings between arresters were varied from installing the arresters at exposed points on the line to a spacing as close as 1,000 ft. By using various spac-

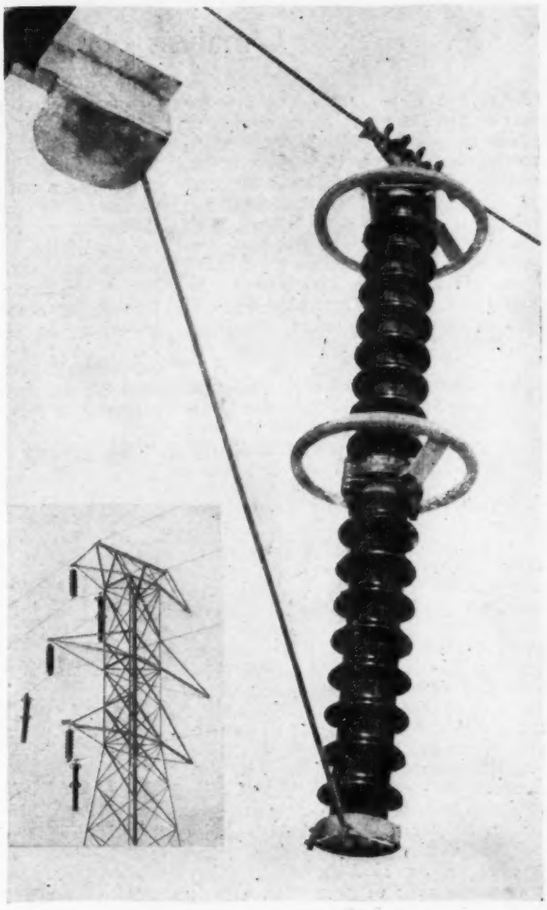
ings, it was expected that after several lightning seasons data would be obtained which would make it possible to determine the degree of protection afforded by various spacings. Increased knowledge of the behavior of lightning on transmission lines has furnished a basis for the calculation of the expected protective zone of line arresters, as shown by the preceding example, and it is now a purpose of the tests to correlate these data with the theoretical calculations.

Another purpose of the field investigation is to secure data on the ruggedness of the type of arrester proposed for this service, which is probably severe, because it may be expected that, with arresters distributed along the line, one or two sets will be in close proximity to the origin of every lightning surge. Arresters of the line type, of cross-section of discharge current equaling that used in standard distribution arresters but with varying detailed construction as to series gaps and method of mounting, were used.

Two types of series gaps installed

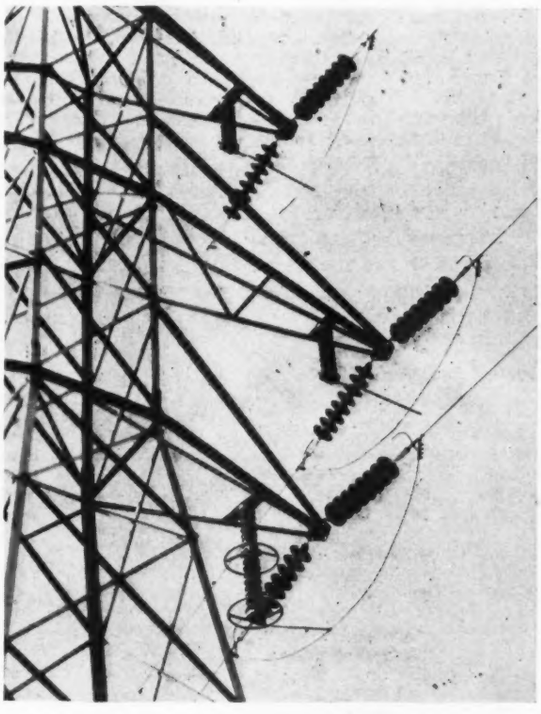
The series gaps used are of two types. One type consists of a multiplicity of small gaps in series inclosed in a porcelain case, similar to the inclosed gap which has been standard on autovalve-lightning arresters. The other type is a long, open gap formed between the line conductor and an electrode attached to the arrester element. Such a gap, due to the small size of electrodes, has a relatively long opening. In most installations half of the arresters have inclosed gaps and half have open gaps.

The impulse characteristics of the inclosed multiple-series gap approach those of a sphere gap, while those of the long, open gap approach those of a horn gap.



Installation on 110-kv. line

Arresters are hung from line conductor about 3 ft. from insulator string



Installation on a 66-kv. line

Arresters of both open and inclosed gap type mounted underneath the crossarm

Hence for steep front waves the breakdown voltage of the open gap will be somewhat higher, and the zone of protection of these arresters may be somewhat less than that of the arresters with integral inclosed gaps. It is one of the purposes of the field investigation to determine whether there is a difference in the protection afforded by the two types. So far none has appeared.

Various methods of mounting employed

The type of mounting used depends on the tower construction, clearances, etc. Some have been suspended from the line conductors, others mounted on the crossarms, and others on brackets attached to the towers. On all installations special pains were taken to insure, as far as possible, that the failure of an arrester would not involve crosses between wires, but would permit clearing of the line by expulsion of the element or destruction of the arrester.

The results obtained so far from the present field installations, while not conclusive, are encouraging. The nature of such a project, because of the many variable factors entering into the problem, makes several seasons' experience necessary to prove the measure of its worth. While the authors believe that the field experience gained so far is not sufficient to draw definite conclusions regarding the success of this project, the results are significant in that they point to the ruggedness of the

Analysis of the Experience on Six Lines

A 22-Kv. Pin Type Line.—The first installation of arresters for the protection of a transmission line against insulation flashover was made in April, 1927, on a 22-kv. line insulated with pin insulators on steel towers. This line is located underneath a high-voltage line on the same towers, with two ground wires above. The arresters were not spaced equally along the lines, but were placed at towers which appeared to be particularly exposed. This was done in an effort to determine whether protection at these exposed points would reduce the trouble.

The operating records of this line prior to 1926 are not complete, but the complete records for 1926 show that the line flashed over twenty times. In 1927 LV arresters were installed and only two flashovers occurred. In 1928 only three occurred. The frequency and severity of storms during these years were very much the same, as indicated by the number of disturbances over the entire system, which indicates that the performance of the line was improved by the addition of arresters.

Up to August 1, 1929, there were five flashovers, but on August 23 during one storm seven flashovers occurred. The storm on this date, however, was one of the worst ever observed in this locality and considerable trouble was experienced on other lines in the same area. Even including this storm, the records show improved operation over that of 1926.

There have been no flashovers on towers protected by arresters, although the records show six cases where the adjacent tower flashed over during 1927-29. Calculation of the expected zone of protection in this particular case shows that such flashovers may occur. The margin between the flashover voltage of the pin insulators used and the arrester voltage is small. The smaller this margin, the shorter the length of the line which the arrester will protect, and for surges with 150 kv. per microsecond, or more, rate of rise the arrester will not protect very far ahead of its location on this particular installation.

Since the arresters were installed only at a few exposed points, a considerable section of the line was left unprotected from the lightning.

Further proof of the effectiveness of the arresters in reducing line flashovers is shown in the operating record of a small section of the line. The section for seven towers out from the station, which is protected by electrolytic arresters, was the hardest hit before the line arresters were installed. In 1926 there were eight flashovers on this section alone. Arresters were installed on towers 3 and 7, and since their installation no flashovers at all have occurred in this section.

A 66-Kv. Two-Circuit Line on Steel Towers.—The arresters are on the circuit designated as No. 11, which is insulated by seven disks in suspension and eight in strain with arcing horns. The other circuit, No. 12, is on the opposite side of the towers and is insulated with eight disks in suspension and nine in strain with no arcing horns. It has no arresters, but is equipped with fused grading rings on the first fourteen towers at each end of the line. The line has no overhead ground wires except at each end, where it extends for thirteen and seventeen towers. A very thorough record of the performance of this line has been kept by the power company's engineers for some years back. The record for 1929 with arresters installed does not make apparent any great reduction in the number of outages on circuit No. 11, but the fact that no flashovers occurred nearer than two spans to an arrester is considered significant, especially since these flashovers occurred in regions where the tower footings, and therefore the arrester ground resistances, were high. Another significant fact is that in the past circuit No. 11 has flashed over a great many more times than No. 12 because of its lower insulation. The ratio of single-circuit outages on No. 11 to those on No. 12 has been about four to one. The installation of the arresters has reduced this ratio to two to one in 1929.

In reference to the matter of ground resistance, it may be significant that in the section of the line which, judging from its performance from 1924 to 1929, is the most exposed, as 45 flashovers out of a total of 72 for the entire line occurred here, no flashovers have occurred since the arresters were installed. In this region the ground resistances are of a generally low order. The authors hesitate, however, to attach too great weight to this in view of only one season's operation with arresters.

In the light of the 1929 experience, some of the ground resistances have been lowered and additional arresters installed in order to pursue this study further. It is hoped that the 1930 season will considerably amplify the data thus far secured.

A Single-Circuit 110-Kv. Line.—This is on steel towers insulated with seven disks in suspension. For purposes of trial, a spacing of 2 to 3 miles between arresters was chosen. In the light of our present knowledge, calculations show that this order of spacing leaves a considerable portion of the line unprotected. Considering the number of outages which occurred on this line after the arresters were installed, it might appear that they were of no benefit. When we consider that the severity and frequency of the storms which occurred in this area in 1929 were estimated to be three times those of 1928, it may be said, assuming that the outages would increase with the storm severity and frequency, that the arresters have cut the number of outages in half. This may be an optimistic view which will require substantiation by further observation.

Again, no flashovers occurred closer than two spans to an arrester. There was one such flashover. In no other cases were there any flashovers closer than five spans to an arrester location. The order of tower footing resistances on this line is, in general, low.

arrester for this type of service as well as the correlation between the effectiveness of the arresters in service and the calculations.

The investigations are being continued and pursued further by the addition of arresters to existing installations and by new installations on different types of lines. These additional installations should permit definite conclusions as to the merits of this program.

These rather extensive investigations can only be carried out with the hearty co-operation of the utilities on

Table I—Field Data on Trial Installations

Line No.	Circuit Voltage, Kv	Line Insulation	Type of Arrester	Date Installed	Spacing	No. of Arrester Locations	Length of Line, Miles	Lighting Outages 1926	1927	1928	1929	Flashovers Nearest to Arrester: Distance	Flashovers Nearest to Arrester: No. Since Arrester Installed	Single Pole Arrester Damaged
1	22	Pin insulators on steel towers.	Special disk type autovalves.	April, 1927	Exposed points	8	12	20	2	3	12	1 span	6	4[1]
2	22	Pin insulators on wood poles.		Aug., 1929	1,000 ft.	90	20	No comparative data available at present.				....	..	....
3	66	7 units in susp., 8 in strain, steel towers.		June, 1929	1 mile	22	22	33	7	9	11–8[2]	2 spans	3	None
4	66	5 and 6 on steel towers.	Porous block type autovalves.	Winter, 1930	Exposed points	10	..	No comparative data available at present.				....	..	....
5	110	7 units in susp. on steel towers.		May-June, 1929	2-3 miles.	19	64	..	..	20	19	2 spans[5]	1	None
6	110	11 and 12 on steel towers.		July-Aug. 1929	Exposed points	34[3]	74	No comparative data available at present.				....		2[4]

[1]Failures caused by mechanical defects. [2]Eleven outages before arrester installation, eight after.
[3]Single-pole arresters, all installed on same phase. All other installations three phase.
[4]One failure during lightning storm, cause of other failure unknown. [5]Nearest other flashover five spans from arrester.

whose lines they are being conducted. The success of this work depends not only on the willingness of the operators to explore new fields but also on their careful collection and analysis of pertinent data. The authors wish to take this opportunity to express their thanks to the Alabama Power Company, Connecticut Light & Power Company, Carolina Power & Light Company, Detroit Edison Company, Pennsylvania Water & Power Company and West Penn Power Company for their valuable contributions to this study.

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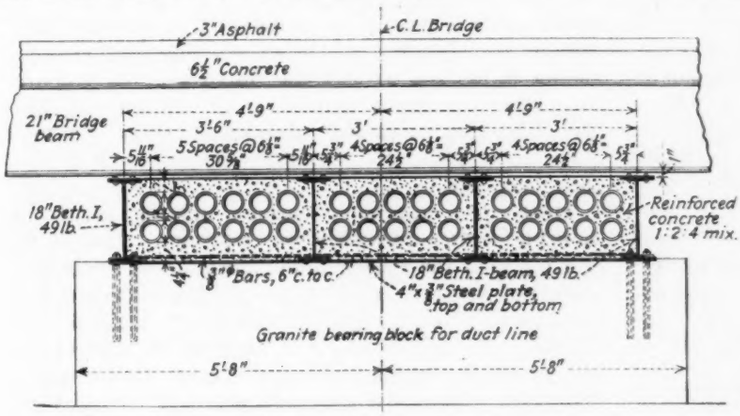
Duct Line Relocated on Bridge During Construction

IN CONNECTION with the building of a new bridge across the Providence River, the Narragansett Electric Company faced the problem of relocating an important line of ducts carrying 22-kv., 11-kv., 2,300-volt series lighting and railway circuits with minimum interruption of service. The old bridge was of steel construction, the duct lines crossing it in wrought-iron conduit. The new structure is of the steel girder type with concrete deck, having four spans about 34 ft. apart. It was desirable to avoid the expense of temporary duct construction if possible. New work included two manholes of three-way and four-way type, respectively, and the problem was solved by designing the new duct system on the bridge as an independent structure of reinforced concrete.

The bridge was built in two longitudinal halves and the new cables had to be in service before the second half was completed. The new duct structure is supported on a concrete-bearing block mounted on the top of the bridge pier and 18-in. I-beams were provided to inclose the concrete surrounding the 4-in. fiber duct carrying the cables, anchor bolts being inserted in the bearing block as shown. In spite of the long span across the river no provision was made for expansion, the assumption being that the structure inclosing the ducts will be sufficiently flexible under local weather conditions. Service was interrupted only long enough to transfer the loads from the old to the new cables.

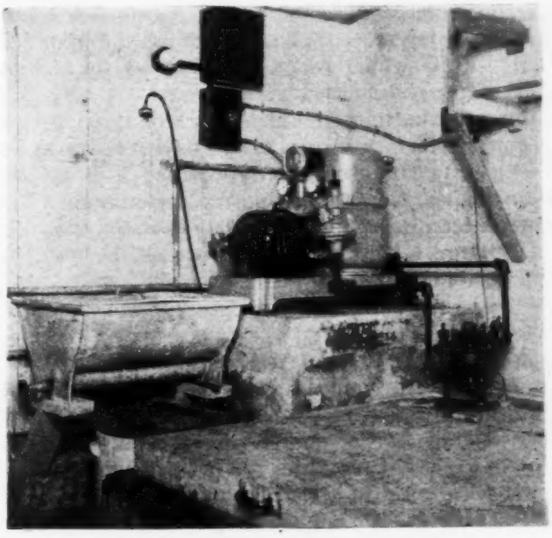


Cross-section of ducts at center pier

Scalding Tank Boosts Rural Load in New York

By CHARLES H. CHURCHILL*
Vice-President and General Manager
Cortland County Traction Company, Niagara-Hudson System

DEVELOPMENT of new applications in addition to intensive selling of standard equipment is being actively carried out by the Cortland County Traction Company in the building up of its rural farm load in New York State. The latest innovation along this line is the electric scalding tank, which consists of a cast-aluminum tank with an immersion heating element. This device is used in the milk room to heat water for scalding pails, strainers, dippers and other small utensils. It also finds application in the preparation of powdered skim-milk calf rations and in the scalding of chickens.



Scalding tank and milk cooler installation

The cooler is shown in the foreground and the scalder next to the wall. These appliances are used in the milk room on the farm of Floyd Wilkins. Each of them consumes approximately 120 kw.-hr. per month.

It combines a water-heating tank with a rinsing vat and maintains a high temperature throughout all scalding operations.

The 2,000-watt immersion heating element provides enough heat to raise five gallons of water to a scalding temperature (175 deg. F. to 185 deg. F.) in about an hour, or while milking is being done.

The scalding tank, which retails for $35, requires service calls only when it is necessary to install a new heating element. It will be used at least twice daily and will have a monthly energy consumption of from 120 kw.-hr. up.

*Formerly farm service director for Adirondack Power & Light Corporation.

If Rural Service Is to Pay*

By H. C. THUERK

Manager of Power Sales Associated Gas & Electric System, New York City

AN INCREASE of approximately 70 per cent has taken place in the number of new rural customers served and in miles of lines built in New York State during the four years ended Dec. 31, 1929, but the full benefit from the use of electricity on the farm is not to be derived merely by extending our lines and connecting the customer to the distribution system. To thousands of farmers, electricity means merely a more desirable type of illumination. They do not know that there are today more than two hundred different services on the farm which can be performed by the proper application of electric power.

Can rural business be made to carry its own cost and yield a satisfactory return to the power company? The answer is in the affirmative, provided it is possible to obtain higher average bills per customer than we obtain in urban territory. It is absolutely essential that comparatively large quantities of energy must be used by the rural customer.

Six years ago the average consumption of farm customers was about 300 kw.-hr. per year. When it is taken into consideration that this building of load on the farm is still in its infancy there is much cause for gratification in the fact that at this early period almost every one of our 48 states offers examples of farms using in excess of ten times the old average. The report of the rural electric service committee of the N.E.L.A. issued in May, 1929, gives a list of farms where the consumption is in excess of 3,000 kw.-hr. per year. One company in the Middle West reports that in 1925 the monthly consumption per farm customer was 22 kw.-hr. In 1928 this had been raised to 66 kw.-hr., or an increase of 200 per cent. The essential load building equipment used in this territory were the range, water pump, milking machine, feed grinder and silo feeder. One farmer in each three in one of the best developed sections of this company grinds his feed and fills his silos with utility motors of from 3 to 5 hp.

Another company, also in the Middle West, increased its kilowatt-hours per rural customer 44 per cent from 1925 to 1927. In this same period the number of farms increased from 1,600 to 4,300.

A company in the South having 5,500 rural customers on December 31, 1928, has increased its rural consumption from 383 kw.-hr. per customer in 1924 to 834 in 1928. Another company in the far West reports an increase in consumption per customer of 30 per cent in four years. This increase is exclusive of energy used for irrigation purposes.

In a section in Pennsylvania which is not considered especially good rural territory the average consumption of 205 rural customers was raised from 640 kw.-hr. per year in 1928 to 747 kw.-hr. per year in 1929. This represents an increase of about 17 per cent. In one of the companies in your own state of New York records show that on twelve rural extensions current usage has been increased 30 per cent in 1929 over 1928.

The most enthusiastic rural electric consumers are those who use the largest amount of energy. Complaints from farmers come chiefly from those making a very restricted use of the service.

To be successful in developing its farm load a utility company must be guided by executives who believe that farm electrification can be made to pay its own way, that there is a load on the farm sufficient in amount to justify the expenditure which is required for distribution lines, that the farmers can afford to pay the necessary charges for this service, and that they can profit by its use. Utility executives should appreciate that farm electrification is a big job and that it calls for the expenditure of large sums of money in distribution systems.

A definite sales plan must be provided for developing this business. Since this activity differs materially from others, it is undoubtedly wise to create a separate department for it.

Some Uses of Electricity on the Farm

Farming Aids	Domestic Appliances
Bottle washers	Toasters
Milk cooling	Percolators
Feed grinding	Waffle irons
Shearing and clipping	Cookers
Pumping	Heating pads
Ensilage cutting	Corn poppers
Threshing	Electric irons
Farm lighting	Portable heaters
Water heating	Portable lamps
Brooders	Ice cream freezers
Incubation	Cooking
Ventilation	House lighting
Milking machines	Radio
Churns and cream separators	Domestic refrigeration
Soldering irons	Washing and ironing machines
Utility motors	Sewing machines
Apple graders	Vacuum cleaners
Oat sprouters	Dishwashers
Hay hoists	Floor scrubbers and waxers
Drills and grinders	
Vegetable washers	
Fire and burglar alarms	
Immersion heaters	
Hatchery sun lamps	
Light trap for insects	

Members of a rural service department should not only be familiar with the company's rules, wiring policies and requirements, and fundamentals of the public utility business (for the farmer is surely going to ask him many questions about the company), but they should have a general understanding of farming and be able to discuss improved farm methods intelligently. I cannot stress too greatly the importance of employing men who have some knowledge of the farming industry. The most successful salesmen are those who understand their prospects' problems and are able to speak their language.

Most rural customers consider lighting as the most valuable service furnished by electricity. Just as there is a big field for raising illumination levels in the home, store and factory, so is there the same opportunity on the farm. Every progressive farmer in the future will light his yard adequately and we shall find higher lighting intensities in the home and various farm buildings. After the farmer has adopted higher standards for the use of electricity on his farm you will find that he will

Excerpts from "Future Farm Loads," a paper presented by Mr. Thuerk at a recent meeting of the Commercial Section of the Empire State Gas and Electric Association at Rochester, N. Y.

soon be demanding adequate lighting for all highways in the vicinity of his property.

Irrigation each year is becoming more important to the agricultural industry. A field heretofore given little attention, not only on the farm, but elsewhere, is that of ventilation. Refrigeration in many cases has not been used to the fullest extent. The Illinois Farming School in one of its reports states that refrigeration should easily make up 23 per cent of the mechanical power on the farm. Consideration is now being given in several sections of the country to the use of electricity in the artificial drying of hays and grasses.

To date the electric motor has been practically limited to operations on the farm where the prime mover is stationary. The possibility of employing electricity for field work should be explored. In this connection it may be interesting to note the progress being made in Italy in the application of electricity to agriculture. One of the most unique and, at the same time, successful developments there has been the electric plow with electric costs comparable to energy charges in California.

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Reflections on the Value of Miniature Buses

ZEALOUS disciples of plant simplification have been overheard discussing the possibilities of getting rid of dummy buses on switchboard fronts, but other engineers have lost no time in springing to the defense of these orthodox appurtenances. It is too early to open a special savings account in honor of departing equipment of this type. The contentions of the iconoclasts are interesting if not convincing. They do not pretend to maintain that the capital savings resident in the elimination of miniature buses are of a high order, but, in the fashion of the day, they have been questioning the utility of these long-accepted devices on the ground that they represent a needless expense and are apt to be of little value in operating emergencies. Why, then, should the electrical engineer add to the complexity of switchboard construction? Does not the qualified operator know the front of his board as well as the inside of his own home, both with and without lights, and in emergencies what time has he to trace dummy bus connections and set-ups which should be a part of his own mental system if he is to be an efficient employee of his department?

These are specious questions which overlook the major values involved in switchboard operation. Because an experienced operator can handle his board under very adverse conditions, and possibly even in the dark in some cases, it by no means follows that he should be deprived of any reasonable convenience in doing his work. Switch manipulation can be achieved faster and more accurately with good lighting, and in the same way the dummy bus serves as a guide to proper action even if it is merely glanced at in times of stress. Nay, more, it is useful even if the operator refers to it subconsciously. Correct action is fundamental to the maintenance of good service standards and to the prompt restoration of normal conditions. The "complications" introduced by dummy buses are negligible in most cases; the cost of including them on the panel front or top is small in proportion to the total cost of modern control wiring, and finally, they are extremely useful in the training of new operators and in familiarizing men transferred from one plant to another with the essentials of the local layout. The penalties of operating mistakes far offset the cost of these conveniences, although such devices cannot take the place of intelligence. Experienced operating opinion seems to be well in favor of their retention for a long time to come.

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Cable Grips Show Savings in Wire Pulling

CABLE GRIPS have long been used on lead-covered cable for pulling-in, but in wiring the new Chrysler Building in New York Hatzel & Buehler, Inc., adopted them for branch circuit conduit work with appreciable savings in wire and labor.

The grip method entirely does away with the old method of skinning the wires, bending the copper conductors through the hook in the fish wire and twisting them together. In the Chrysler Building most of the runs were of four No. 14 rubber-covered wires. Under the old method it was necessary to strip back each wire about 3 in. and this wire was cut off and thrown away. Figuring 3 in. on each of four wires meant a foot of wire wasted on every pull. Of the 1,500,000 ft. of wire pulled in the Chrysler Building at least 1 per cent was saved, or 15,000 ft. on this one job. Only sixteen grips were used for the entire 1,500,000 ft.

The new method is also much quicker—the wires are merely held together and slipped into the grip—the whole operation taking about half a minute.

The grip used in the Chrysler Building takes from two to five No. 14 rubber-covered or equivalent. Kellems Products, Inc., is the manufacturer of this piece of equipment.

LIGHTING—

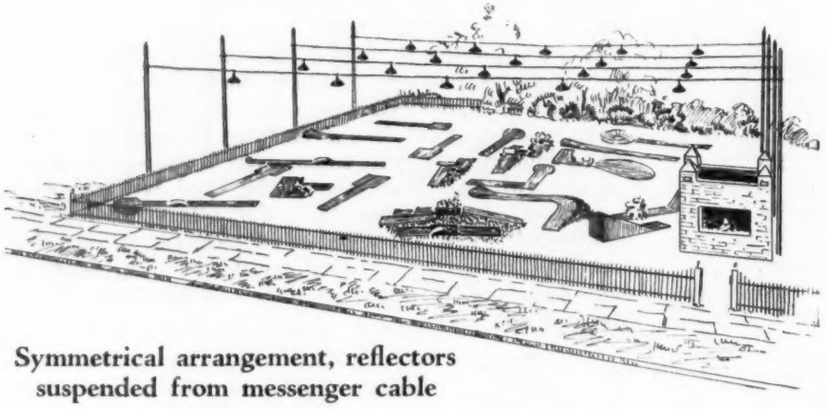
for All-Night Miniature Golf

ALMOST without warning a new lighting market,* that was not anticipated at all, has landed on the central station, contractor, dealer and equipment manufacturer. There are 25,000 miniature golf courses now in operation, according to a Department of Commerce official; if these are all lighted, in some fashion or other—and general observation leads one to conclude that most of them will be—this means a market created for more than $10,000,000 worth of electrical equipment and installation business, and a yearly revenue estimated at $10,000,000 to $12,000,000 for central stations.

*See also "Miniature Golf Presents New Lighting Load," ELECTRICAL WORLD, *July 19, 1930, page 127.*

Large electrical jobbers report that their marginal business this summer has come from outdoor sports lighting, principally miniature golf, and that this has been their salvation in an otherwise depressing year. The accompanying figures and data represent financing in lighting systems. Cost figures given are based on actual cases, but will vary with labor and material in various localities.

Lighting from units in the center of the playing area is most favorable from the standpoint of shadows, if the general progression of play is in a clockwise direction, since right-handed players in the usual case are not between the light source and the ball. Conversely, with boundary lighting schemes, the usual counter clockwise layout of course is the more favorable.



Symmetrical arrangement, reflectors suspended from messenger cable

Total Cost: Around $600 for a course of average size.
Reflectors: Standard industrial units, such as RLM, deep bowl or oxidized aluminum reflectors with weatherproof holders.

Mounting Height—Spacing: 15 to 25 ft. off ground; spacing between rows and between units should not exceed the mounting height.

Lamp Size: 300 to 1,000 watts per unit, depending on the spacing. White bowl lamps recommended with RLM reflectors. Wattage varies from a minimum of 1 to around 2 watts per square foot of playing area. Use No. 12 wire or larger and guard against excessive voltage drop.

Remarks: Probably the most common system. Effective distribution of light with good uniformity, soft shadows and minimum glare. Simple to install, but not particularly decorative. Higher mounting, where practicable, to minimize glare, also for better appearance and to keep bugs and insects up, away from the players.

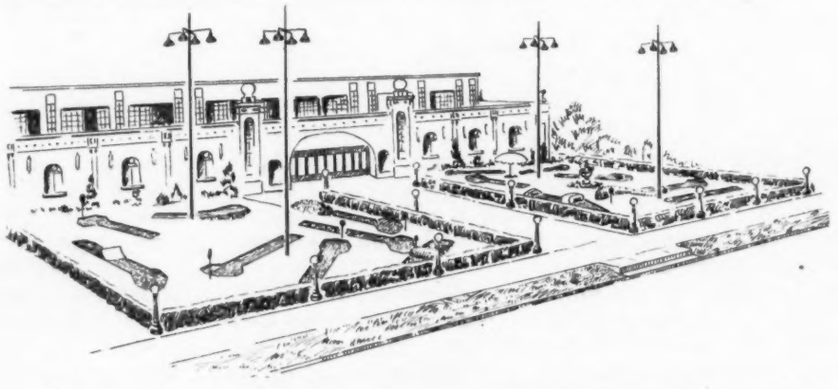
Each pole supports four reflectors on short bracket arms. Length of bracket governed by facility for maintenance and lamp replacements. Installation and equipment cost approximately $150 per pole.

Reflectors: RLM, deep bowl porcelain enameled or aluminum reflectors with weatherproof holders.

Mounting Height and Spacing: Reflectors 35 to 40 ft. above ground. For good distribution, poles should not be more than 50 ft. apart.

Lamp Size: 750 or 1,000-watt lamps. Usual wattage between 1 and 2 watts per square foot. Should be wired for at least 2 watts per square foot.

Remarks: Installation makes good appearance—fewer units using high-wattage high-efficiency lamps an element of economy. High mounting minimizes glare and avoids the nuisance of insects swarming near players. Often desirable to supplement with ornamental units of relative low wattage around playing boundaries, both for added attractiveness and for the additional lighting value because of the lower illumination close to the boundaries where the principal units are so centered within the playing area.



Two or more steel poles set in concrete symmetrically spaced in playing area

By C. E. WEITZ

National Lamp Works,
General Electric Company,
Cleveland, Ohio

Floodlights mounted on poles at boundaries of playing area

Eight to twelve units required. Equipment and installation cost averages around $80 per unit.

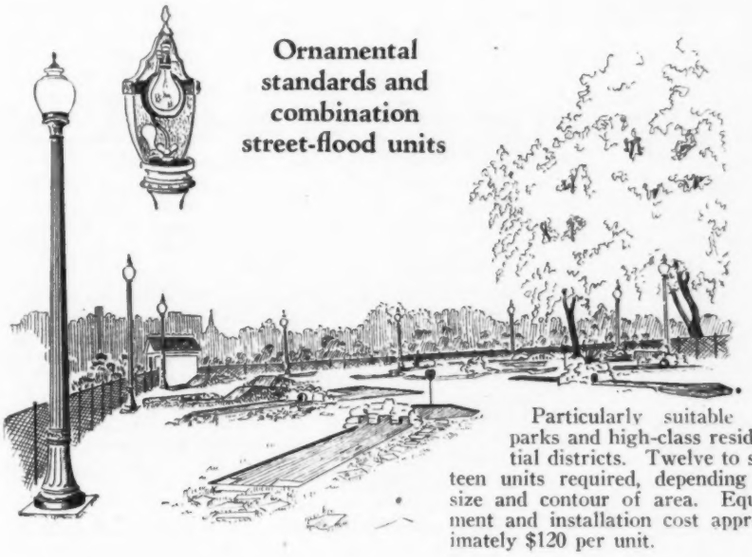
Type of Floodlight: 1,000-watt inclosed medium-beam floodlights or open reflector type units such as used for gasoline service station floodlighting.

Mounting Height: At least 30 ft. off ground, preferably higher, in order to reduce glare. Spaced at regular intervals around boundaries to avoid harsh shadows and so aimed as to cover the area uniformly.

Lamp Size: 1,000-watt lamps generally used; wiring capacity should be provided for additional wattage.

Remarks: Satisfactory if sufficient number of units are used to insure lighting the area uniformly without harsh shadows and glare.

Ornamental standards and combination street-flood units



Particularly suitable for parks and high-class residential districts. Twelve to sixteen units required, depending on size and contour of area. Equipment and installation cost approximately $120 per unit.

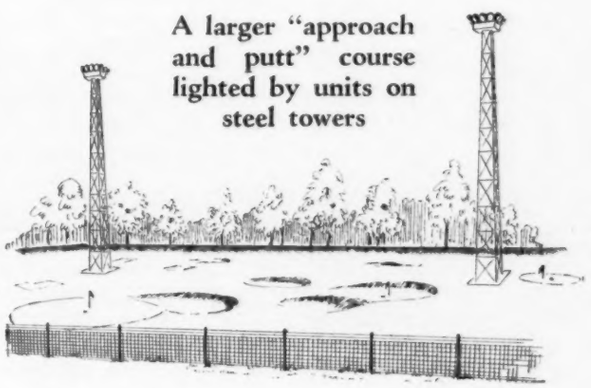
Type of Unit: Ornamental metal posts with street-lighting globes fitted with floodlighting mirror to project the light to playing area. Standard and globe should be in harmony with adjacent street-lighting standards.

Mounting Height—Spacing: From the standpoint of appearance and co-ordination with adjacent street lighting, the usual mounting height is from 15 to 20 ft. Because of the lower mounting height more units are required for even distribution. Units are usually spaced 30 to 40 ft. apart to provide coverage.

Lamp Size: 1,000-watt lamps for floodlight beam; oftentimes supplemented by auxiliary 200-watt lamp back of mirror to illuminate portion of globe darkened by the shadow of projector mirror.

Remarks: This system gives an attractive appearance and, though more expensive, has been adopted for public park areas and better residential districts. The lower mounting height introduces more pronounced glare than with other systems where the light sources are further from the line of vision.

A larger "approach and putt" course lighted by units on steel towers



Approximate cost $600 per tower.

Tower and Reflectors: 75-ft. fabricated steel towers, set in concrete foundation, with platform for mounting lighting units. Towers are 150 ft. apart, each with fourteen 1,500-watt units. Units may be regular inclosed floodlights, or open type concentrating reflectors. Units adjusted and aimed to cover playing area.

Remarks: When open reflectors are used, the mouth of reflectors should be covered with screening to keep out bugs and insects, as experience indicates excessive lamp failures similar to "water cracks" due to bugs and insects swarming on hot bulb. High mounting avoids glare and gets the light sources out of range. Schedule for more permanent enterprises.

Distinguishing Braids for Control Cable

By J. B. MacLEAN
J. G. White Engineering Corporation

THERE has always been a surprising lack of co-ordination or standardization in the specifications of purchasers of multi-conductor control cable. Specifications have been prepared with the hope that the marker braids would be easily distinguishable. Manufacturers can testify to the presence of numerous specifications which cause them extra work and consequently raise the average cost of the article.

There are several ways the actual colors may be specified. There is, however, a standard color card issued by the Textile Color Card Association of the United States which has general acceptance in textile work. This card definitely designates about 200 standard colors or shades by giving cloth specimens of these colors. From actual experience it has been found advisable to select but seven of the nine principal colors. As may be seen in Table I, white has been defined by three distinct shades selected from this card, and these allow a reasonable variation, which is not great enough to cause confusion between white and yellow or orange. Similarly, red, orange, green, blue and violet have been defined.

Those who have had experience with control cable installation know very well that colors quite distinguishable in daylight seem identical under actual conditions of installation. Yellow and white, whether used in the same braid or as markers in separate brains, are extremely hard to distinguish. This is also true of dark blue shades with black and certain lavenders with green. It has been found that grease and dirt raise as much havoc with the identification of dark combinations as with lighter ones. Generally the darker combinations are harder to distinguish, whether fresh or dirty. Also certain shades are dull. Table I has been prepared with the idea of giving vivid basic colors that must be easily distinguishable under actual conditions of installation. Also, the arrangement of control conductors in groups of four or five is generally a natural one and seems advisable.

With these factors in mind, tables of color markings were prepared and used in actual installations. Table II is the result of this investigation. For a seven-conductor cable, the manufacturer uses the first seven colors specified in Table II; for 23 conductors, he uses the first 23, etc.

It will be noticed that three color braids are used in cables having more than 23 conductors. This arrangement has been found satisfactory. By using it, many of the dubious two-color combinations may be eliminated from the sequence. In the table the second color is the marker and the third (when present) the tracer as shown in the accompanying illustration. Experience has taught that it is worth while to specify markers at least $\frac{1}{4}$ in. wide. The tracer in three-color braids may be smaller. It has been found that arrangement of three colors, as in the illustration, is more easily distinguishable than other arrangements.

At the present time there is a national committee working toward a standard color code for marker braids. The color code outlined here is the result of construction experience and is submitted with the hope that it may assist the national committee considering the problem and crystallize present ideas.

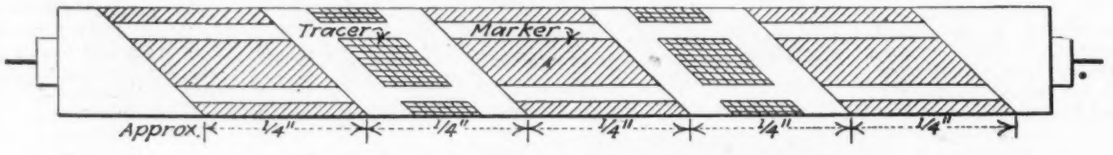
Table I—Standard Color Code

Issued by the Textile Color Card Association of the United States, 200 Madison Avenue, N. Y.

Card No.	Colors — Basic	Colors — Shade	Textile Color Card — Std. No.	Card — Cable No.
1	White	White	S-1,001	1
		Ivory	S-1,041	2
		Cream	S-1,045	3
2	Red	Scarlet	S-2,003	19
		Carmine	S-2,263	111
		Cherry	S-2,063	89
3	Orange	Orange	S-3,005	52
		Jasmine	S-4,004	037
		Golden rod	S-4,025	51
5	Green	Emerald	S-5,005	36
		Spring green	S-5,043	113
		Jadeite	S-5,165	040
6	Blue	Peacock	S-6,505	92
		Bluebird	S-6,065	112
		Empire blue	S-6,692	042
7	Violet	Lilac	S-7,163	93
		Violet	S-7,003	100
		Pansy	S-7,005	101
9	Black	.....	.....	...

Table II—Suggested Coloring of Control Cable Braids

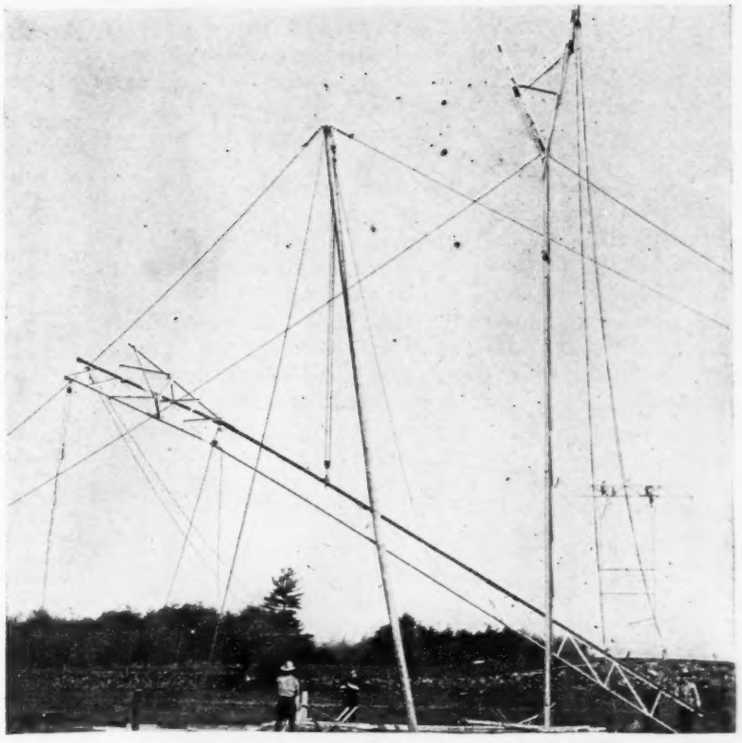
Conductor Number	Basic Colors	Conductor Number	Basic Colors
1	Black	25	White—Green—Black
2	White	26	White—Orange—Black
3	Orange	27	White—Violet—Black
4	Violet	28	White—Blue—Black
5	Blue	29	Red—Green—Black
6	Black—White	30	Red—Orange—Black
7	Black—Red	31	Red—Blue—Black
8	Black—Green	32	Orange—Violet—Black
9	Black—Orange	33	Orange—Blue—Black
10	Black—Violet	34	Black—Red—White
11	White—Red	35	Black—Green—White
12	White—Blue	36	Black—Orange—White
13	Orange—Violet	37	Black—Violet—White
14	Orange—Blue	38	Black—Blue—White
15	Red	39	Green—Red—White
16	Red—White	30	Green—Orange—White
17	Red—Green	41	Violet—Orange—White
18	Red—Orange	42	Red—Green—White
19	Red—Blue	43	Red—Blue—White
20	Green	44	White—Black—Red
21	Green—White	45	White—Green—Red
22	Green—Orange	46	White—Orange—Red
23	Violet—White	47	White—Violet—Red
24	White—Red—Black	48	White—Blue—Red



Suggested method of arranging two- and three-color markers on control cable

By HARRY J. KINGSLEY

Construction Superintendent
New England Power Construction Company,
Worcester, Mass.



Erecting tower leg with gin pole

Speeding Construction of 220-Kv. Aluminum Line

SYSTEMATIC procedure maintained the construction schedule on the New England Power Association's 220-volt, 126-mile line built between the Fifteen-Mile Falls lower development on the upper Connecticut River and Tewksbury, Mass. It was completed sixteen months after excavation was started for tower footings. Each of the two initial circuits of 795,000-circ.mil. aluminum conductor is carried by semi-flexible steel tower lines spaced 183 ft. apart on a 350-ft. right-of-way. The line is of the cross-country type and mechanical methods were effective in every phase of its erection.

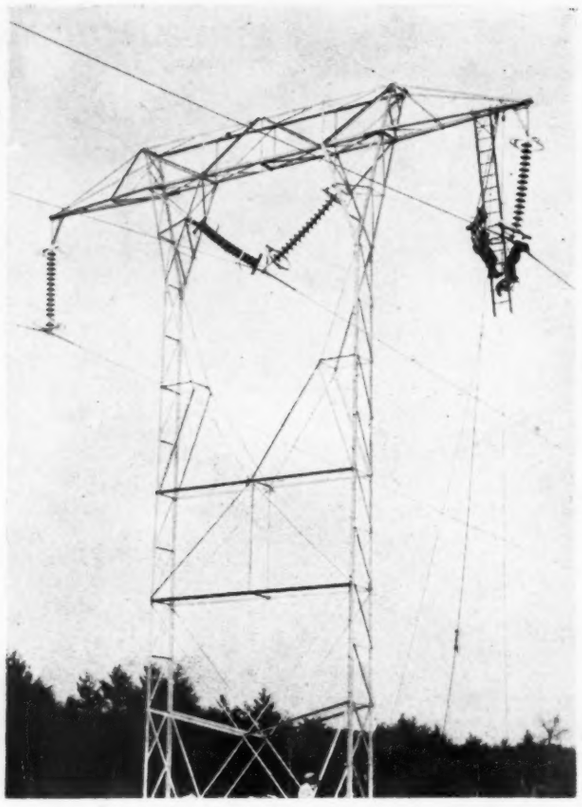
The clearing of the right-of-way was in itself quite a task. The first 80 miles on the north end of the line were cut through very heavy timber, mostly hardwood, although some lots of spruce and pine were encountered. The construction schedule required that the clearing be completed in fourteen months, and to accomplish this four crews, totaling about 350 men, were engaged. Camps built to accommodate 175 men were established 20 miles apart, from which the crews worked 10 miles in each direction. As the different operations of line construction followed each other closely, one crew would move out of a camp and another would immediately move in.

The timber was cut into 12- and 16-ft. logs and anything smaller was left at sled length and piled along the right-of-way, 50 and 175 ft. from the edge. The brush was piled in four windrows along the line 40 and 125 ft. from each edge of the clearing. This brush was later burned under the supervision of a state fire warden. On April 1, 1929, excavating for and setting of the tower footings was started. It was necessary to set footings for 49 towers each week to meet the schedule and this required a force of about 180 men. Two 3-ton tractors and two 6-ton trailers with caterpillar treads were used to haul the material from the storage yard to where it was to be used. The trailers were purchased without bodies and front gear and special bodies were built to meet the particular requirements. With this equipment it was possible to do the work of eight teams and save approximately $30 per day.

Of the excavations in the first 80 miles of line, 70 per cent were in rock or part rock. By July, 1929, eleven 116 cu.ft. compressors were being used and were moved about with the aid of a 3-ton tractor except when long road hauls were required, when a capstan winch mounted on a 2½-ton truck handled them easily.

The erection of the towers followed, with the steel being delivered in the same manner as the footings. After the crews were better organized it was possible to complete 45 towers a week with two assembly crews instead of three as originally started out. On the flexible type 55-ft. suspension towers used on the line the ½-in. extra strength galvanized ground wire was strung shortly after the towers were erected. Each circuit has two ground wires clamped to the top of each tower.

The 795,000-circ.mil aluminum conductor was furnished in 4,100-ft. reels weighing about 2½ tons, which were readily handled by a capstan winch mounted on



Attaching aluminum conductor to suspension insulator

a truck. The cable was pulled out by a tractor and by making temporary core splices two and three reels were run at a time. Running blocks having an aluminum shell with a 12-in. aluminum roller bearing sheave were used. The conductor was protected from injury by rocks and ledge when being run by laying logs along the ground. The insulator strings, consisting of fifteen 10-in. disks, were placed in position with the grading ring assemblies and other hardware. The conductor was raised and held in position until correctly sagged by means of a winch mounted on a tractor and then clamped.

Approximately 560 freight carloads of material had to be shipped to fourteen storage yards before the job was completed. Each separate piece had to be checked when unloaded and distributed to the proper location at the time it is needed, in order not to delay the construction crews.

The equipment used in the construction of the line included five tractors, fifteen teams, eleven compressors, 29 trucks and fourteen gasoline-driven pumps. Six construction camps were operated and an average of 669 men has been employed.*

*From the transmission line engineering department of the New England Power Association the following additional particulars of the tower erection methods followed on this line have been furnished the ELECTRICAL WORLD:

During the peak of construction the erection crew consisted of three gangs of about sixteen men and one team each. Each gang was assigned a section of line between roads, where it erected the towers and then bypassed the two other crews, taking the next unerected section between roads. This process is repeated until the line is completed.

Each of the sixteen-man gangs is split into several smaller groups. One group sorts the pieces and arranges them about the footings, also assembling and bolting together certain parts of the tower more easily handled as a unit, such as a pair of legs with the longitudinal bracing complete. The next group erects a gin pole, hoists the tower legs into position with a team and sets in place and bolts the first panel of the transverse bracing previously assembled on the legs of the first group. Next the gin pole is lowered and taken to the next location, the guys holding up the legs. The other braces are bolted in place by a third group, which also assembles the crossarm angles. A temporary longitudinal guy wire is attached to each face of the crossarm in order to keep the tower from undue strain in case of a windstorm. Up to this point the bolts have been tightened only by hand. The final operation in erection is performed by two men following the other groups. Their duty is to tighten all nuts and burr the threads of all bolts to prevent loosening of the nuts during operation. The average progress for a sixteen-man gang has been about three towers per day, including square towers. These last take about three times as long to erect as the semi-flexible towers.

Two tractors and two trailers replaced eight teams and saved about $30 per day in material haulage

Metermen as Accurate as the Meters

METERMEN attending the short course at the University of Illinois were the object of an accuracy study reported by J. D. Krackenbuehl and M. A. Faucett to the Great Lakes Division of the N.E.L.A. They were asked to check ten revolutions of a meter, the snap switch starting and stopping a cycle counter instead of a standard meter. The actual number of revolutions of the meter was recorded through the medium of a photo-electric relay accurate to better than one-hundredth of 1 per cent. It was found that the difference in watt-hours between the highest and lowest observed values was only 0.035, or 1.4 per cent. The normal deviation was only 0.31 per cent, showing that the metermen as a rule are as precise as the standards they use in their routine testing.

If the meterman is supplied with an unfamiliar potential switch, he will anticipate the end point and tend to set the meter fast. Freedom from the smoking habit makes the tester only slightly more reliable—an average error of 0.113 per cent instead of 0.073 per cent for the non-smoker. Nor does wearing glasses make any significant difference. It was also concluded by the investigators that mature age and extended experience had little effect on improving the accuracy of the metermen's timing.

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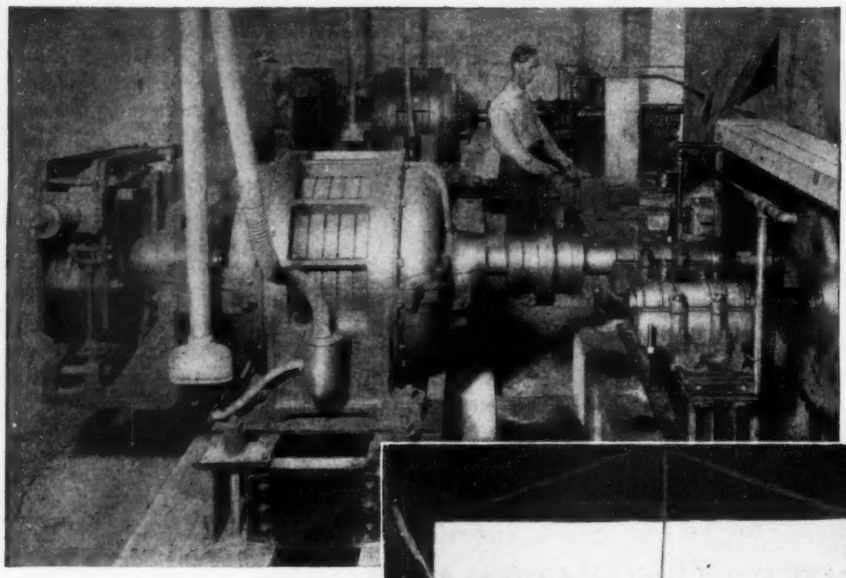
TYPICAL BAKE OVEN INSTALLATIONS ANALYZED*

Location of Customer	Ohio	Massachusetts	Massachusetts	New York	Pennsylvania	Michigan	Illinois	California	Oregon	Connecticut
Total connected load, kw.	160	47	60	9.1	18.2	27.3	55	96	10.5	225
Connected load of each oven, kw.	80	47	.....	9.1	18.2	27.3	55	24	8.4	225
Voltage and phase of oven	220 volts, 3 phase	.....	.....	120 volts, d.c.	220 volts, 3 phase	220 volts, 3 phase	220 volts, 3 phase	220 volts, 3 phase	240 volts, s'gle phase	220 volts, 3 phase
Number of decks per oven	2	.....	.....	1	2	3	2	3	2	3
Square feet of baking area	.....	.....	.....	22.5	45	67.5	140	66	7	.....
Kind of products baked	Pastry and bread	Rolls, pies, pastry	Bread, rolls pastry	Pastry and bread	Pastry and bread	Pastry and bread	Bread, cake, rolls, pastry	Puff pastry, cakes	Cakes, pies, rolls	Bread, rolls, biscuits
Quantity of products baked per day (output).	Varies	2,500 rolls, 65 pies, 35 doz. cookies, 150 pcs. French pastry	140 lvs. bread, 180 doz. rolls, 50 doz. muffins, 100lb. puddings, 325 pcs. pastry, 50 doz. cookies, 70 cakes	.....	Per month 10,800 lb. pullman bread, 4,200 rolls, 600 pies, 90 cakes	Per week 11,000rolls, 300 loaves bread, 3,500 cakes	.....	.....	800 cakes, 150 pies, 500 rolls (per month)	20,000 25,000 lb
Actual baking hours in a day	18 to 24	12	12	8 or 9	6 or 7	.....	7	8	8	10
Is steam used?	No	.....	.....	No	Yes	.....	Yes	No	No	Yes
Source of steam	.....	.....	.....	.....	Central steam plant	.....	Coal steam Boiler	.....	.....	Oil fired boiler
Means of temperature control	Manual	.....	.....	Automatic	Automatic	Automatic	Manual	Automatic	.....	Automatic
Load factor in per cent	51.6	25	.....	.....	.....	32	39.1	.....	7	.....
Kilowatt-hour consumption per month	23,600	6,000	25	1,250	1,970	5,000	5,154	11,700	600	40,000
Half-hour maximum demand in kw.	78.8	.....	8,000	.....	.....	21	23	.....	.....	200
Average cost of power per kilowatt-hour, cents	1.8	1.4	1.4	5	.....	3	2.97	1.29	3	1.05
Annual revenue to power company	$3,000.00	$1,000.00	$1,600.00	$750.00	.....	$1,500.00	$1,850.00	$1,812.00	$250.00	$5,000.00
Remarks	.....	.....	.....	Used 5½ years; very satisfactory	Max. mo. production required. 42.5 bbl. flour, 2,400 kw.-hr.	.....	This is the second bakery this man has built with this size electric oven	.....	.....	.....

*From a report of the commercial cooking committee of N. E. L. A., "Marketing Electricity for Baking."

Special Motors Increase Tramway Speed

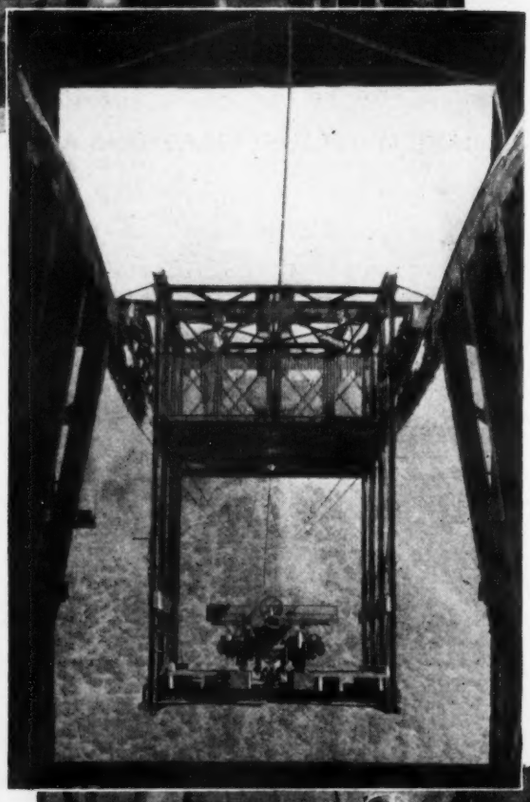


Two 225-hp. motors, electrically and mechanically in parallel, operate the 2,600-ft. tramway

ELECTRIFICATION of a 2,600-ft. tramway for transporting lumber in carloads across the American River Canyon in California involved an interesting problem in motor application and control. From a study of the duty cycle on an old steam-driven outfit in operation since 1901 it was determined that two 225-hp., wound-rotor, intermittent-duty, hoist motors operating electrically and mechanically in parallel would meet maximum power requirements. Wound rotor motors were chosen because of the very high torque requirements of the tramway drive.

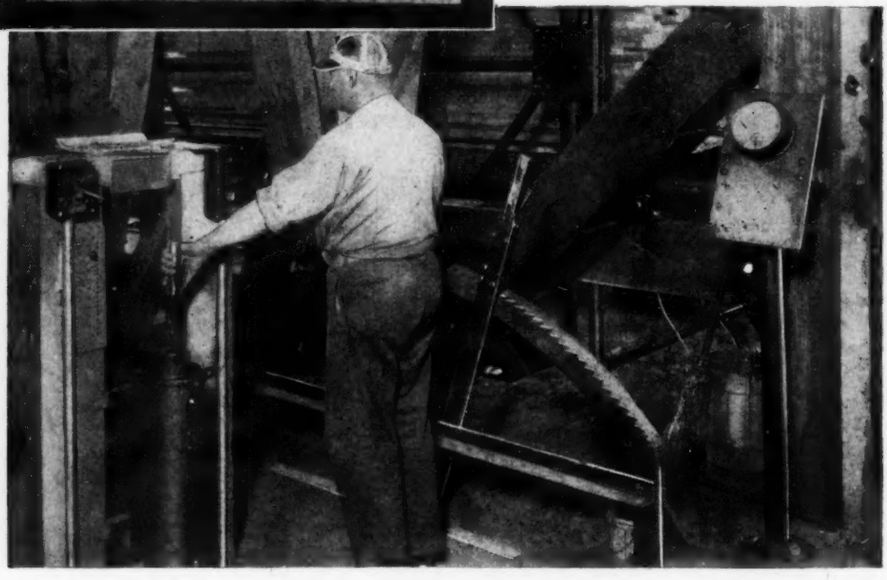
Certain special features had to be incorporated into the control equipment. A double-drum geared limit switch is provided to bring the motors to a standstill automatically as the carrier approaches either terminal. These are four graded steps, three slowdown steps and one final or stop step at which solenoid brakes are automatically applied. An "inching" control was provided since it was impracticable to attempt to adjust operation of the limit switch for accurate spotting of the carrier. This inching control is carried across the canyon on a pole line so that the operator at either terminal may bring the carrier to the desired position at his terminal. An interlocking system takes control away from the main operator at the discharge terminal as long as the operator at loading terminal is using his "inching" control. As soon as the carrier is loaded the operator at the loading terminal transfers control to the discharge terminal by means of a push button.

At the discharge terminal it is necessary to move the carrier up an angle of about 20 deg. and during this process



Lumber car carrier approaching discharge terminal

Control station at discharge terminal showing controller and "inching" buttons



Magnetic contactor board and resistance grids

the motors are called upon to develop very high torque. For this reason connections on the rotor resistor grids had to be adjusted to permit maximum torque output. Starting and acceleration are accomplished by manual operation of the master controller at the discharge terminal. After the carrier is once started and brought up to speed no further manual control is necessary since the limit switch will automatically stop the carrier at the other end of the tramway. A mechanical brake is used to bring about a smooth stop.

The new tram is designed to carry a narrow-gage railroad car loaded with lumber and to make seventy trips in an 8-hour shift. Maximum weight of carrier and loaded lumber car is 58,000 lb., 24,000 lb. of which represents the loaded car. Four locked coil cables 2 in. in diameter support the 32-wheel carrier. On one side of the canyon these supporting cables are anchored to a 350-ton block of concrete. Constant tension in the cables is maintained under varying conditions by passing them over 5-ft. sheaves on the other side of the canyon and attaching to each cable a 60-ton counterweight. The steel traction rope consists of 6,600 ft. of 1-in. steel cable which passes over two 96-in. sheaves geared to the motors at the discharge terminal.

The speed of the old steam carrier, which was 1,200 ft. per minute, has been increased to 1,800 ft. per minute with the electrified tram. At a speed of 1,800 ft. per minute, or about 20 m.p.h., a trip across the canyon requires 105 seconds.

Contract for the complete installation was taken by the United States Steel Products Company. Complete design and manufacture of mechanical equipment was in the hands of the American Steel & Wire Company. Electrical design and equipment was sublet to the General Electric Company. Power for the tramway motors is supplied by the Pacific Gas & Electric Company from a special substation which is connected to a nearby 60-kv. line.

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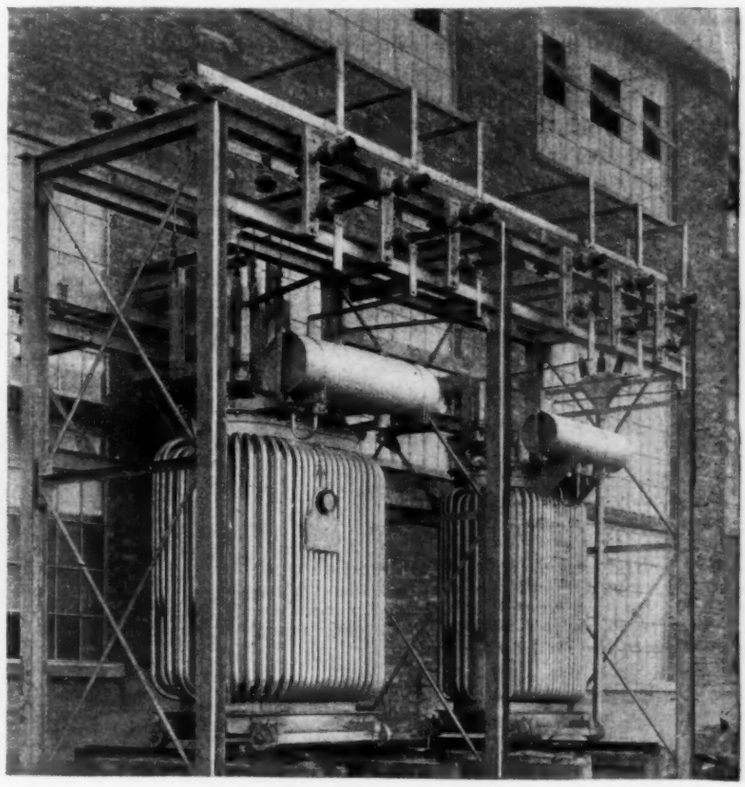
All-Aluminum Conductors for Industrial Substation

To serve a heat-treating furnace and auxiliaries at the Massena (N. Y.) mill of the Aluminum Company of America this transformer installation is placed close to the point of utilization, minimizing low-voltage line losses. The busbars and conduit for these 1,500-kva., 6,600/220-volt and 750-kva., 6,600/440-volt units are all of aluminum. For coating the circulating coils of the transformers, aluminum paint, with its high heat-radiating properties, has been used.



Electric Railways in Italy Use 3,000-Volt D.C. Service

By NIKOLAY VON KOTSCHUBEY
Zurich, Switzerland

THE experience of privately owned railways with 750 miles of electrified sections using both motor-generator and mercury-arc rectifier direct-current sources has led to 3,000-volt service by the majority of Italian carriers. Latest adherents to this standard are the state-owned lines, which have abandoned three-phase operation for the proved advantages of direct current in their recent electrification of lines in the southern part of Italy.

The privately owned railways have been electrifying for nearly ten years with voltages in excess of 2,000. The possibility of installing mercury-arc rectifiers in light and inexpensive buildings, as well as the great savings in electric energy which can be made in consequence of the high mean efficiency of the substations, has allowed a great number of private companies which ran small and unimportant railway lines to improve their precarious financial position. Consequently, in substation equipment the trend has been recently to high-power mercury-arc rectifiers rather than motor-generators. Rotary converters cannot be used, as the direct-current voltage seems to be too high to allow them to work satisfactorily under the severe conditions which occur on railway service. The newest mercury-arc rectifier substation is fitted with special regeneration devices consisting of high-speed voltage relays and resistances, which allow the energy generated in the traction motors to be absorbed when braking. The whole system is fully automatic.

The longest direct-current railway line in Italy is the Sangritana, which has a total length of about 93 miles with a pressure of 2,600 volts. The rating of each of the five asynchronous motor-generators used on the Sangritana line is 600 kw. at 2,600 volts d.c. and each is capable of being overloaded up to 780 kw. for one hour. The asynchronous motors are connected directly to the 3,300-volt, 42-cycle, three-phase side of a 900-kva. transformer with a ratio of 30,000/3,300 volts. The power factor of the motor-generators varies between 0.91 at full load and 0.86 at half load. The direct-current pressure is regulated by means of high-speed direct-current pressure regulators.

Synchronous motor-generators are in use on the Turin-Cirie-Lanzo, Como, Biellesi, Rome-Ostia and Spoleto-Norcia railways. The motor-generators of the Rome-Ostia Railway consist of two direct-current generators of 450 kw., 1,300 volts each, connected in series, two separate exciters, and one synchronous motor of 950 kw. at 1,000 volts. The Spoleto-Norcia Railway employs synchronous motor-generators, consisting of one synchronous motor of 650 kw., 3,000 volts, 50 cycles and a single direct-current generator, 600 kw. at 2,600 volts.

However, the majority of substations working at 3,000 volts are provided with mercury-arc rectifiers, and the results obtained in service have been very satisfactory, indicating that the decision of the Italian State Railways authorities to proceed with high-tension direct-current electrification on a more extensive basis is quite justified.

High Voltages Used in Italian Railway Electrification

Railway Line	Track Length, Miles	Voltage	No. of Sub-stations	No. of Units and Capacities of Each, Kw.	No. of Locomotives	No. of Multiple-Unit Coaches	Speed of Passenger Trains, Maximum M.p.H.	Electrified Since
Twin-Lanzo	26.4	4 000	1	3–650	5	2	45	1921
Biella-Andorno-Balma*	20.9	2,400	1	3–600 1–1,100	—	9	25	1924
Sangritana	93.2	2,600	2	5–600	11	6	28	1924
Rome-Ostia	15.5	2,600	1	3–900	8	5	40	1925
Spolleto-Norcia	31.9	2,600	1	2–650	—	5	28	1926
Bribano-Argordo	18.0	2,400	1	2–500	4	–	31	1925
P. S. Giorgio								
Fermo-Amandola*	36.9	2,600	1	2–700	5	3	28	1928
Milano-Saronno*	27.7	3,000	1	3–2,000	3	8	50	1928
Calalzo-Dobbiaco*	40.6	3,000	1	2–1,100	2	6	28	1929
Arrezo-Singlunga*	24.9	3,000	1	2–600	5	5	50	1929
Pescara-Penne	22.7	2,600	1	2–700	2	3	28	1929
Vicenza-Recoaro-Chiampo*	32.1	3,000	2	2–1,100 2–750	3	7	50	1929

*Company using mercury-arc rectifiers

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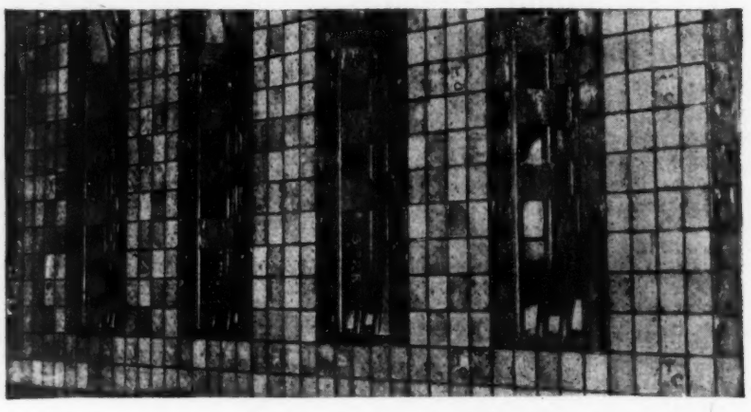
Flame Control Improved by Multiple Fuel Burners



Pulverized fuel is used at the new 1,400-lb. pressure South Amboy, N. J., steam station of the Jersey Central Power & Light Company, and in order to secure accurate combustion control for varying loads five burners per boiler, each fed by its own mill, are used, the number of burners in service increasing or decreasing according to the load on the boiler.

A Critical Analysis of the Lighting Situation

By M. M. SAMUELS
J. G. White Engineering Corporation

Co-operation by various interested parties to the cause of adequate, artistic, effective, pleasant and economical lighting has grown apace in the past few months. Mr. Samuels has reduced the oft-debated problem, as he sees it, to workable essentials in which all have their rightful place.

AN ARCHITECT'S time is spent on co-operation and compromise, co-operation with the structural engineer and the construction man, compromise with numerous laws and burdensome regulation, co-operation with owners, tenants and financiers. The architect does not attempt to dictate to the structural engineer the sizes of steel members to be used, nor does he dictate the size of steam pipe to the mechanical engineer or the size of feeder cable or transformer to the electrical engineer. The architect is probably the man whose mind runs most along the lines of co-operation and compromise.

The electrical engineer too—and here the definite term "electrical engineer" is not to be confused with the vague term "lighting man"—is trained in co-operation and compromise. In the design of a power house, for instance, the electrical engineer must co-operate with the manufacturer of the apparatus, the architect, the structural engineer, the mechanical engineer, the operator and a number of others, and must always be ready to compromise.

No architect and no engineer ever refuses to co-operate. He is always ready to modify and adjust his ideas to the needs of others.

Therefore, the phrase "lack of co-operation," so popular in the field of illumination, must be based on misunderstanding, and misunderstanding among engineers should not be so difficult to clear up, once the factors are defined with approximate correctness.

To be sure, there are abuses. When activities develop rapidly abuses, misunderstandings and overstepping are bound to occur. Let those whose toes feel the overstepping realize that it is not willful, that it is not intentional, that every one is merely trying to get there.

But the time now seems to be ripe for differentiating and defining the functions of the men involved, since it would be difficult to define the problems themselves. An attempt may be made to establish a division of work, a definition of the duties of each man who is to participate in the solution of illumination problems, because no illumination problem can or should be solved by one individual or one organization. These functions are divided among the following groups: (a) Architects, (b) illuminating engineers, (c) lamp manufacturers, (d) fixture designers, (e) electrical engineers, (f) public utilities, (g) electrical contractors.

Architect.—It is the architect's prerogative to specify where bright light and where dim light are desired, where color is to be used, how much and what quality of color is necessary. He is the only person who can visualize the composite interior or exterior effect because he creates it. He expects and wants the effect to appear to an observer in a certain way. Therefore he is entitled to specify and demand that the illumination installation shall give him these results. He is glad when the burden of engineering the equipment to bring about these results is taken off his hands. He is not interested in the details, but he is jealously guarding his architectural features, lest some incompetent lighting installation spoil the whole architectural conception.

In the case of decorative fixtures it is for the architect to specify the design, form and color effects to harmonize with his whole conception of an interior or an exterior. The architect should go so far and no further. If he goes beyond this he does not function as an architect, but as a member of other branches listed here.

Illuminating Engineers.—The architect presents his

Causes of Inadequate Lighting

Some electrical engineers assume that they are also illuminating engineers and undertake the design and specifications for lighting equipment.

Some illuminating engineers presume to undertake both architecture and electrical engineering functions.

Some architects attempt to do both the illuminating and electrical engineering.

Some electrical contractors either presume or are forced to combine the functions of architect, illuminating engineer, fixture designer and electrical engineer.

lighting requirements to the illuminating engineer, and it is for the latter to find the means to solve this problem or to state that the art of illumination has not progressed far enough to solve it. In general, the architect is pretty well versed with present conditions and will not present problems impossible of solution. The illuminating engineer must have a sufficient understanding of architecture to appreciate the architect's problem. He must be familiar with all available lamps, reflectors and other lighting equipment; he must know all their characteristics and limitations, as well as their cost. Even though he may not be able to appreciate architecture he must not presume to criticise the architect's ideas; he must take them for granted and must find means to provide lighting conditions to meet them. He must know glass and must know colors, and how to produce desired colors. He must know light, but he must also know darkness, because architects often justly insist on comparative darkness in some places. He must be an experienced judge of the products of fixture manufacturers, and must decide in each case on the most competent man to produce the equipment.

The illuminating engineer's position, in some respects, is comparable to that of the patent attorney, who, being without a practicing engineer, must have a sufficient knowledge of engineering and finance to appreciate engineering and finance values.

A distinction will have to be made between the illuminating engineer designing lighting equipment and one designing lighting installation. This distinction is not dissimilar to the one existing between the electrical engineer designing turbo-generators, transformers or insulators and the one designing power systems. Assuming both to be competent, a close co-operation between them is generally obtained without any great effort.

Lamp Manufacturer.—The lamp manufacturer is primarily a manufacturer. He wants to sell as much of his goods as possible, and he wants to manufacture goods that will sell better. Consequently, he is always trying both to improve and to cheapen his products, and he has been exceedingly successful in both. He must have his ear to the ground and anticipate public demand, and here too he has been very successful. He must prepare data on his product and make it available for every one who is contemplating using it. It is also his duty and privilege to advertise and broadcast any amount of facts which will tend to increase the demand for his product.

But first and last his duty is to produce and sell as much of the product as possible. Standardization of lamps is only a part of improving and cheapening the product, and here too he has been remarkably successful, as is evidenced by the ever-decreasing demand for special lamps. The data so generously prepared by lamp manufacturers will always be welcomed and appreciated by every one connected with the art of lighting.

But it is to be doubted whether the free engineering advice offered by them, no matter how unselfishly and sincerely offered, will ever be used by the better architects. There is always the unavoidable prejudice against some one who has something to sell.

In general, lamp manufacturers have shown more open-mindedness toward suggestions from outside than have other manufacturers, or even other departments of the same manufacturer. Just now they are studying the problem of the longitudinal lamps, brought about by the longitudinal fixtures designed along the modern American skyscraper lines. So far this problem is still awaiting a solution, but a real serious effort on the part of the lamp manufacturers will no doubt soon produce a solution.

Fixture Designer.—It will help a great deal to clear up the confusion which undeniably exists in the fixture field to bring out the fact that there are distinctly three types of fixtures: (1) Purely utilitarian; (2) purely ornamental, and (3) combined utilitarian and ornamental.

The design of the first falls exclusively within the province of the illuminating engineer, and, fortunately, it has practically been handled exclusively by him. This comprises the great majority of industrial and street lighting units, steel reflectors, mirror reflectors, glass refractors and diffusers, etc. For industrial purposes, therefore, there is no difficulty in obtaining the correct units and the correct data pertaining thereto. The progress has been orderly and evolutionary.

The purely ornamental fixture is of very little moment in a discussion of illumination, because it is not intended to serve as an illuminant and involves problems of decoration only, except that a wise fixture designer will consult the illuminating engineer and get the benefit of his experience in the use of luminous colors. However, it may be mentioned that such purely decorative articles are often sold for illumination purposes, to the great disappointment of the buyer and the user.

It is the unit which serves both purposes, that of decoration and that of illumination, which has been and still is the greatest bone of contention in illumination, even though here, too, great progress has been made in very recent years. The proper procedure for the design of such fixtures would be for the illuminating engineer, after obtaining the necessary instructions from the architect, and after himself studying the particular problem of illumination, to decide upon the number and location of units, the types of reflectors, diffusers and other accessories. This should then be turned over to the artistic fixture designer, who should again study the architect's instructions, and then design the decorative parts of the fixture accordingly. It seems a rather tiresome procedure, but it is necessary, and it will also be necessary for the architect, illuminating engineer and the fixture designer to go back and forth, and each modify his ideas somewhat to make the other's task easier or even possible. Such back and forth references are quite

Recommended Functions of Different Groups

***Architect*—Specify the desired lighting effects.**

***Illuminating Engineer*—Decide upon the required equipment and its location to obtain the specified effects.**

***Fixture Designer*—Design the exterior of these equipments.**

***Electrical Engineer*—Design the conduit system, wiring system and switching system.**

***Electrical Contractor*—Install the system.**

common in other fields of engineering, because jacks of all trades are not good engineers, and there is no reason why the same procedure should not be useful in illumination.

Electrical Engineer.—The electrical engineer is often confused with the illuminating engineer, simply because most light used now is electric light. But there is also gas light and there is daylight, the treatment of which has nothing to do with electrical engineering. Whenever an electrical engineer is engaged in the solution of a problem of illumination he does not function as an electrical engineer, but as an illumination engineer.

There is a distinct field for him, however, in illumination which is precisely electrical engineering, and that is the design of the power supply and wiring system. It is his duty to design the conduit system, wiring system, switching system, and protective system. It is his function to check up on voltage regulation, demand, reliability of service and form of contract. It is strictly within his province to look into the future and to provide a competent wiring system to take care of future growing loads. He is singularly competent in planning for the future; he does it daily in planning power systems and industrial plants. The reason so many buildings are equipped with insufficient wiring is due to the fact that the wiring system has been designed by an incompetent electrical engineer or none at all.

Public Utility.—It is the first and last function of the public utility to find means to build up its load and to provide the best possible service to the customer. It is entirely within its function to spread the knowledge of lighting, to induce its customer to take more advantage of the available service. But the selling of energy and the furnishing of service remains its only function. It is well for a utility to maintain a lighting service department to advise customers on illumination, but it is doubtful whether the architect or the public in the long run will have confidence in this advice, regardless of the unselfish and reliable manner in which it is generally furnished, because here too there is the prejudice against one who has something to sell.

But so long as an independently practicing profession of illuminating engineers is virtually impossible at the present time, the engineers of the lighting service departments of the utilities have the most important duty to perform. Their actions, their engineering methods, their integrity or lack of same will contribute more than anything else to raising or lowering the respect of the public and the architect for the illuminating engineer.

Electrical Contractor.—It is the duty of the electrical contractor to install the equipment and wiring as specified, no more, no less. If he does any of the other work, he does not function as a contractor, but as an engineer, architect, etc. He should not be called upon as a contractor to do any engineering or designing, and particular attention should be paid in the preparation of specifications and drawings to make sure that the contractor will have a definite basis on which to bid and not have to modify or supplement work without equitable compensation.

This division of responsibilities is not theoretical. It is practical, even though one profession may have to overlap the other. But the lines of differentiation in duties are marked, and they are straight lines. It is hoped that this differentiation will assist in lifting the cloud which hangs over all discussions on illumination.

Resistance Brazing Proves Economical and Strong

ELECTRICAL brazing by the resistance method shows many advantages over soldering, in the opinion of development engineers. It is said to be quicker, less expensive and more satisfactory, as the conductivity, mechanical strength and durability are higher than with a lead joint.

Brazing with this equipment is caused by the heat generated by the flow of electricity through carbon blocks. As these blocks offer high resistance to the flow of electricity, the heat generated is correspondingly high and but small pressure is needed to complete the joint.

The equipment consists of a transformer, foot switch and tongs for holding the carbon blocks and work. A typical General Electric Company equipment involves a 5-kva. transformer weighing 45 lb., having a 220-volt primary and an 8-volt secondary.

Improved brazing method requires little equipment

The various parts to be brazed are either designed with flat surfaces, to begin with, or are flattened before brazing. After the work is clamped in the tongs, flux is added and the current is turned on by pressing the foot switch. When the flux melts, the brazing alloy is held against the hot metal until alloy flows into the joint by capillary attraction. During the process of brazing the hot alloy dissolves a thin film of the metal surfaces, thus forming a new alloy rich in copper and with a higher melting point than the original alloy.

How Wesleyan Seminary Benefited

By WIRT S. SCOTT

Special Representative
Westinghouse Electric & Manufacturing Company,
Mansfield, Ohio

TO DETERMINE the economic value of electric heating over coal for cooking and baking purposes in institutional work the Genesee Wesleyan Seminary* of Lima, N. Y., was selected at random from a number of such institutions. Detailed evidence of the tangible values of electric heating in connection with such applications was obtained.

Before the installation of electrical cooking apparatus all cooking and baking were done with two coal ranges and one brick bake oven. Appreciating the fact that the cooking and baking results were not in keeping with the other standards of the institution, due to the use of inadequate equipment, it was decided to install a model kitchen which would do justice to the quality of foods purchased. After a thorough investigation of the various types of equipment suitable for the purpose a complete electric kitchen and bake shop was installed.

With the installation of this equipment a new power rate was made available, making the average rate for the entire load 3.41 cents per kilowatt-hour, whereas the average rate before was 4.25 cents. This new rate reduced the lighting cost about $22 a month. Before the installation of the electric cooking apparatus the rate was as follows: 40 kw.-hr. at 9 cents per kilowatt-hour; 60 kw.-hr. at 8 cents per kilowatt-hour; 100 kw.-hr. at 6 cents per kilowatt-hour; excess at 4 cents per kilowatt-hour. Now the power rate is: 500 kw.-hr. at 3 cents per kilowatt-hour; excess kw.-hr. at 3½ cents per kilowatt-hour; demand charge, 90 cents per kilowatt of demand.

As shown in Table I, an analysis of these costs has been worked out to show the net cost of all baking and cooking purposes per meal cooked and the average monthly cost for all cooking and baking. Table II shows a complete record of the power consumption and current costs for a twelve-month period. Neglecting the September reading, which shows the consumption for the month prior to the use of the new equipment, the average consumption per month is approximately 6,000 kw.-hr. per month and the average cost $201.40 per month for cooking, refrigeration, lighting and miscellaneous power motors.

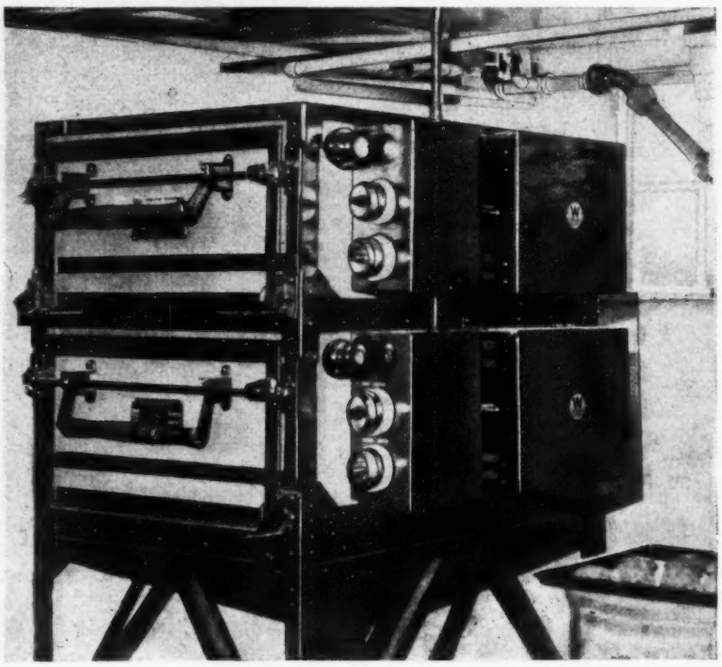
On the basis of a total of 150 persons fed and housed at the school, the average cost per person per month covering the total use of electricity for all purposes is only $1.34, a very small item when considered as such, especially when consideration is given to the usage obtained.

Economy of operation evaluated

1. One man was employed to attend fires, take out ashes, bring in coal, bank fires at night, wheel coal to the supply bin, clean out range and stove pipe, at $60 per month plus board ($15), or a total of $75 a month, or $900 a year.

2. Repairs to coal ranges were high, due to the necessity for keeping fire in the ranges day and night:

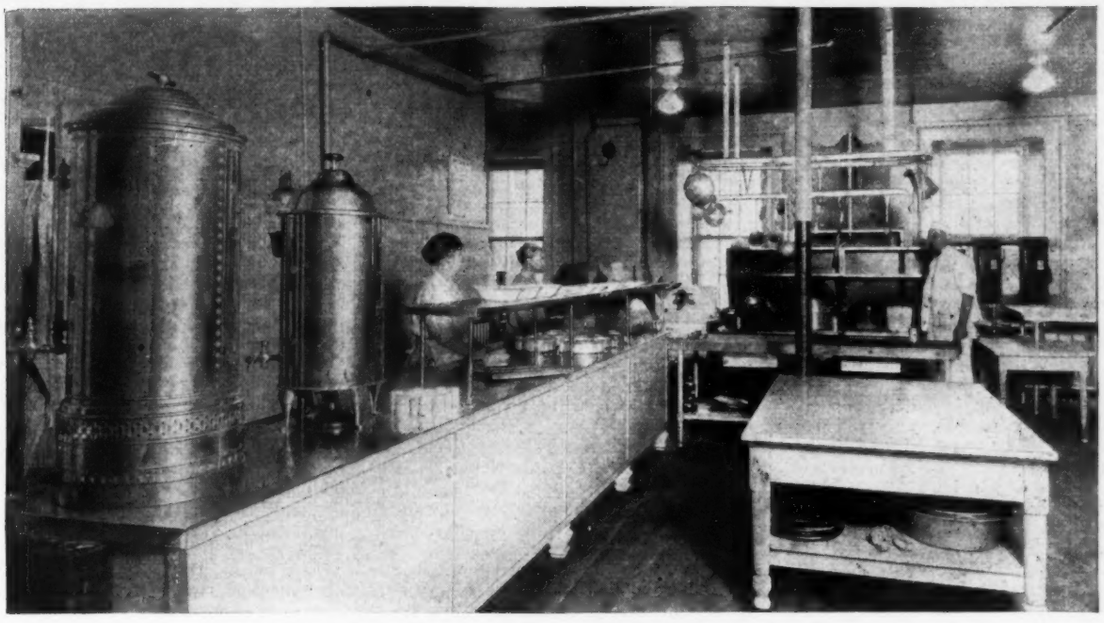
(a) New grates and fire brick every two months at a cost of $5 each time or $30 a year.
(b) New ash pan twice a year, $6 a year.
(c) New dampers every year, $2 a year.
(d) New lids once a year, $4 a year.
Total repair, per year, $42.



Two-section electric bake oven replaces coal-fired oven

**The school is a co-educational institution with a registration of about 135 students, an active teaching staff of fifteen and an administrative staff of eight. The buying of the food products and the planning of the meals is supervised by Mrs. L. M. Black, an expert dietitian.*

by Adopting Electric Cooking



Electrified kitchen at the Wesleyan Seminary

Equipment includes two ranges, one bake oven, steam table, coffee urn, chocolate urn, griddle, cup warmer.

3. Insurance regulations require chimneys being cleaned out twice a year. Cost at $10 each time, $20 a year.

4. Every two months an expert range man and helper were called in to take the ranges apart and thoroughly clean them. This was in addition to the routine cleaning every two weeks by the man regularly employed. Cost per year, $60.

5. Using coal ranges, the boy cleaning pans and pots never got out of the kitchen until long after every one else was through. Now he is out as soon as the rest. The boys are paid 30 cents an hour, so this saving is evident. The time formerly required for the three meals was six hours a day, and is now four hours a day, a saving of 60 cents a day, or $219 a year.

6. Using coal ranges, the kitchen had to be redecorated once a year, in addition to frequent scrubbing of woodwork. With electric heat the walls will not require redecorating under a two-year period, and probably not then, and the scrubbing of woodwork has been reduced very much. The annual saving will be at least $30 a year.

7. Less soap and washing powder is required for washing pans and pots, cleaning the ranges, floors, woodwork, etc., a saving of $5 a month, or $60 a year.

8. The working conditions are so much improved over the coal ranges and oven that it has been possible to obtain help for less salary than formerly paid. The saving amounted to $15 a month, or $180 a year.

9. It is stated that the quality of the cooked foods has been increased very appreciably. This is due to the uniformity of temperature conditions and the exactness

Table I—Net Cost of Cooking and Baking by Electricity at Wesleyan Seminary

For a period extending over several months, the following data were obtained:

Number of meals served	30,260
Kilowatt-hours consumed cooking	22,318
Watt-hours per meal, average	271
Power rate for cooking, net	$0.0269
Cost of current per meal	0.00748
Average monthly cost for current for cooking	75.00

Table II—Energy Consumption and Monthly Bills for Energy Using Electric Cooking and Baking

1928	Kw.-Hr	Bill	1929	Kw.-Hr.	Bill
Sept.	2,000	$101.70	March	6,370	$210.95
Oct.	5,500	190.45	April	6,190	206.45
Nov.	8,420	262.20	May	7,120	229.70
Dec.	6,550	215.45	June	4,980	176.20
			July	4,640	167.70
1929			August	2,310	109.45
Jan.	6,410	211.95			
Feb.	7,340	235.20			$2,317.40

Total maximum demand for lights, motors and commercial cooking and baking equipment, 55 kw.

Advantages cited by institution's dietitian

Some of the benefits of electric cooking, aside from those effected by the financial savings, are evident from the following statement of Mrs. Black:

With coal ranges, one must vary the method of cooking from day to day, depending upon the degree of heat available on top of the range or within the oven. This requires a great amount of skill, plus a still greater amount of watchfulness to secure a properly baked product.

With electric heat, the exact condition or degree of heat can be obtained by the setting of a switch. Every day one knows exactly how long it will take to cook any product, and just how long to leave the heaters on high, medium or low heat to secure the desired result. Knowing just how long it takes, attention between times is unnecessary.

Foods can be kept warm for several hours after all current is turned off, and many things are baked on the stored heat after the current is turned off.

For instance, the bread, made three times a week, is baked entirely on stored heat. The oven is used earlier in the morning for baking rolls and cakes, after which both sections are filled with bread, which is baked for one hour without any current being consumed. The bread is deliciously baked, through and through, browned all over, and every loaf is exactly the same.

Pies have the bottoms, as well as the tops, thoroughly baked. This is impossible with a fuel oven. Pastries and cakes are now deliciously baked every time and are of the finest quality, equal to the very best obtainable at any place at any price.

Before the installation of the electric heating equipment the labor turnover was high, but now this problem has been eliminated, and the help state that they hope that it will never be necessary for them to operate fuel equipment again.

The bake oven occupies less than one-half the floor space used by the coal oven, and it is capable of double the production. Occupying the same space as the coal ranges, the two electric ranges are capable of twice the production of the coal ranges. The saving in floor space resulting from the installation of the electrical equipment has enabled us to make a layout that gives us ample work room, saving many steps and the resultant confusion that unavoidably occurs in an overcrowded kitchen.

Electricity is much faster than coal for cooking. We never have to use the range tops on high heat, except for heating up in the morning, and that takes only from 20 to 30 minutes. We had to keep the coal fires banked all night, and then, quite often, breakfast would be delayed due to not being able to get up heat quick enough; but since using electric heat we have never been late for a single meal. The ovens in the ranges bake much faster than in a coal range, and, again, we never have to use high heat except in heating up. For any baking or cooking operation you can name the electric range when properly operated will do this as fast as, and in most cases faster than, any kind of a fuel range.

Not a cent has been spent for repairs for the electrical equipment. A defect developed in one of the switches in the bake oven, but it did not give us any trouble and was replaced as soon as we reported it.

We have capitalized on electric heating in that the cooked foods are better, there is less spoilage, the kitchen is cleaner, better help is obtainable, there is less shrinkage of meats roasted, and there is less labor for cleaning and for washing pots and pans.

Unquestionably electric cooking will supersede all other methods of cooking for hospitals and for institutional work, because it is the scientific and exact method of preparing foods, and it is as essential to a hospital as good doctors, nurses or medicine. Foods cannot be as healthful as they should be when prepared by the guess method made necessary by fuel heating.

Just as our cook says, she is master of the range, and not its servant. She can make the range do exactly as she wants it to do every time, and without any argument or fear that it will not respond.

of temperature regulation for the various foods. Bread and rolls are better baked, have softer crusts and are not burned or scorched. Roasts of meats are juicier, not dried out or scorched. Potatoes are baked perfectly. Pies have the bottoms perfectly baked. Foods on top of the range may be cooked slow or fast, just as required for obtaining the very best results.

The value of this may be hard to determine, but it, alone, is worth the difference in cost between coal and electricity. Certainly electric cooking adds a value to a meal just as much so as the purchase of a better quality of foods. No one would hesitate to pay 2 or 3 cents more for foods per meal if a better quality were obtainable at such price, and thereby enabling them to serve a better meal. Electric heating certainly increases the value to the meal more than 1 cent possibly could do in the purchase of better foods.

Value of better cooked foods, $100 a month, or $1,200 a year.

10. The spoilage of foods due to burning or scorching has been eliminated, at a saving of at least $10 a month, or $120 a year.

11. The average meat bill, per month, for all kinds of meats, average $637.75. It is estimated that the savings are approximately 8 per cent of the former cost, in reduced shrinkage, amounting to $57 a month, or $684 a year.

12. Cooking utensils, with fuel ranges, last about five years. Scraping on the uneven lids wears the bottoms out. Also the hard scrubbing reduces the life. Subjecting them to uneven heat causes the bottoms to warp and crack. With electric heating the life should be fifteen years at least. Saving per year estimated at $20.

Résumé of Annual Savings Electricity Versus Coal

1.	Labor, one man	$900
2.	Range repair parts	42
3.	Cleaning chimneys	20
4.	Range overhauling, labor	60
5.	Saving labor, cleaning pots and pans	219
6.	Saving in redecorating expense, and general cleaning	30
7.	Saving in soaps and washing powder	60
8.	Saving due to better working conditions	180
9.	Value of better quality of cooked meals	1,200
10.	Saving in spoilage	120
11.	Saving due to reduced shrinkage of meats	684
12.	Saving in cooking utensils	20
	Total gross value	$3,535

Coal costs

Exact data were not available as to the coal consumption, due to the fact that coal was purchased in large quantities for other heating purposes, and no record was kept of the amount consumed by the two ranges, the bake oven and other heating equipment in the kitchen. An investigation of a somewhat larger installation in

Rochester, having eight coal ranges, showed a coal cost of $15 per month per range and a coal cost per meal served of 0.5 cent.

On the basis of two ranges and a bake oven, the coal cost may be approximated at $45 a month, or $540 a year. On the basis of 0.5 cent per meal and 120,000 meals per year, the coal cost would be $50 a month for the ranges alone plus $10 for the bake oven, making $60 a month, or $720 per year. An average of these figures will give a fair value, or $630 a year for coal costs.

Electric energy costs

From the tests given in the foregoing the total cost per meal served is 0.748 cent, and for 120,000 meals per year $900 a year.

Cost of electricity per year	$900
Cost of coal per year	630
Difference per year	$270
Total gross value of electric heating per year over former method	$3,535
Deducting difference between electricity and coal costs	270
Net yearly savings or value of electric heating over coal	$3,265
Approximate cost of equipment installed	3,100
Annual return on the investment, per cent	100

Breakfast is served to the help, consisting of twenty persons, at 6:30 a.m., and the regular breakfast, for 130 persons, is served at 7 a.m. Two of the eight range hot plates are turned on at 5:45 a.m; they are first turned on high heat, then medium, then low; by the time the help's breakfast is ready the hot plates are turned off entirely, and the cooking continues on the stored heat in the heavy cast plates.

The bake oven is turned on at 5:30 a.m. by the watchman, the baker comes on at 6 a.m. and muffins are ready by 6:30 a.m. for the first breakfast, also for the second breakfast at 7 a.m.

The electric griddle is used for toast, pancakes and as an auxiliary to the range for any quick-frying operations at times. Fifty hot cakes, 4½ in. in diameter, are cooked on the griddle at one time. The griddle is divided into three sections, so that any part or all may be used as required. The griddle is turned on every morning when used at 5:45 a.m.

Electric Equipment Installed in Wesleyan Seminary Kitchen

2 Electric ranges, 48 kw. capacity total, with a cooking top 96x39 in. Two ovens are provided, each 22 in. wide, 28 in. deep, 16 in. high.
1 Sectional type bake oven, 40-loaf capacity. Oven is arranged in two independent sections, each having automatic temperature control. Each section has a hearth area 28½ in. wide by 38 in. deep. Electrical capacity 9 kw.
1 Griddle, 4½ kw.
1 Steam table and plate warmer electrically heated, having two meat platters, two gravy bowls and six vegetable pots, all heated with 4-kw. immersion heaters in the water pan and a 2-kw. heater mounted in the plate warmer compartment.
1 Double urn stand, with space underneath for a cup warmer, 1½ kw. capacity.
1 5-gal. electrically heated coffee urn, 2 kw. capacity.
1 5-gal. electrically heated chocolate urn, 2 kw. capacity.
1 Dishwasher, ¾-hp. motor.
1 Potato masher, ⅓-hp. motor.
1 Ice cream freezer.
1 Cake mixer and beater, ½-hp. motor.
1 Refrigerating machine.

The coffee and chocolate urns are turned on at 6:15 and turned off at 7:15 each morning.

The first dinner for the help is served at 11:45 a.m. and for the student body at 12:30 p.m. By 1:30 all are through in the dining room and by 2 p.m. the women are all out of the kitchen. The help comes on again at 4 p.m.

All breads, rolls, muffins, pies, cakes, puddings, etc., consumed are baked in the electric oven. The following items will give an idea as to the products baked:

35 loaves of bread, 1 lb. 4 oz., baked every other day.
14 doz. muffins, three times a week.
14 doz. rolls, three times a week.
53 lb. cakes, four times a week.
12 large coffee cakes, Sunday morning.
8 lb. Johnnie cake every other week.
30 lb. Boston brown bread, every other week.
14 12-in. pies, four times a week.
Puddings, three times a week.
Baked apples, once a week.
Fruit cookies, once a week.
Custards, once a week.

The baking is always finished by 11 a.m., even with the production shown. A much greater production would be possible, if required at any time, by longer hours of use.

In the opinion of Mrs. Black, who supervises the buying and preparation of the food, the electric ranges have ample capacity to handle 250 students just as easily as the present student body. On special occasions, such as parents' day, alumni day and commencement, more than 200 meals are prepared without any special use of the equipment.

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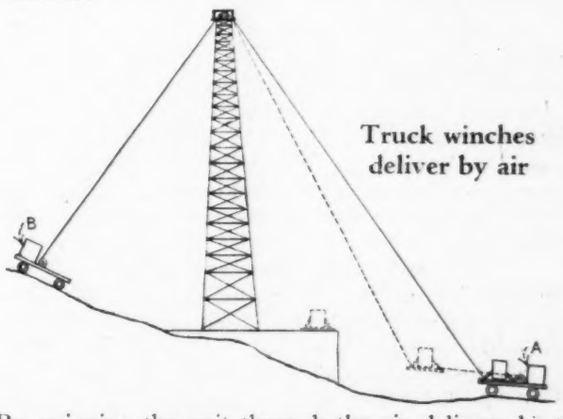
Electrical Equipment Placed Despite Difficult Terrain

WHEN delivery of a control unit for a drilling operation was recently undertaken in an oil field it was found that ordinary delivery methods could not be used, largely due to the loose and broken ground near the derrick.



Truck winches deliver by air

By swinging the unit through the air delivery by the General Electric Company was effected. The drilling contractor's trucks were equipped with winches operated by the truck drive. One truck, *B*, stationed up the slope and on the other side of the derrick, ran a cable up over the crown block sheave and down to the stalled truck, *A*, where it was fastened to the control equipment. A

second cable, from the winch on truck *A*, was connected to the other side of the control. The machinery was then slung through the air and landed on the derrick platform in a few minutes. Men with timbers steadied the unit in its transit to the platform.

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READERS' FORUM

Revised Statistics on British Electrical Industry

To the Editor of the ELECTRICAL WORLD:

We send you herewith data which will be useful in correcting the figures published in ELECTRICAL WORLD of August 9:

1. In our brochure, dated December, 1929, entitled "Generation of Electricity in Great Britain—Year Ended March 31, 1929," one finds the production total of 10,878,980,925 kw.-hr., which corresponds to that which you have given at the top of page 251 in the August 9 issue of ELECTRICAL WORLD, but this total is attributed to the following branches—(a) railway and tramway authorities and certain non-statutory undertakings, (b) authorized undertakers under the provision of Section 27 of the electricity supply act, 1919.

The total of 9,473,000,000 kw.-hr. which you give as the output of "authorized utilities" is close to the total of 9,323,700,000 given on page 12 of "return of engineering and financial statistics relating to authorized undertakings in Great Britain for the year ended March 31, 1929, for public authority undertaking and December 31, 1928, for company undertaking," published in May, 1930, by the Electricity Commission.

It follows therefrom that the total of 9,473,000,000 kw.-hr. corresponds to the total under (b) higher up, and that that of 10,879,000,000 kw.-hr. comprises the total of this sum and of the production in category (a). It is, therefore, an error in the text of ELECTRICAL WORLD when it says that 10,879,000,000 kw.-hr. is the production of street railroad and non-statutory utilities. The real production of these is actually the difference between 10,879,000,000 and 9,473,000,000.

2. The "return" of May, 1930, indicates that the increase in production of "authorized undertakings in 1928-29 is more than 10 per cent over the totals for 1927-28.

3. The same "return" gives, as the total of the average consumption, about 176 kw.-hr. per head of population in arriving at a calculation based on the "sales of electricity by all authorized undertakers."

This figure is accompanied by the following remarks: "This figure relates only to the public supply of electricity and does not constitute a measure of the total consumption of electricity in Great Britain, owing to the existence of numerous stations not belonging to authorized undertakers at which large supplies are generated for traction colliery and other industrial purposes."

UNION GÉNÉRALE BELGE D'ÉLECTRICITÉ.
Brussels.

High Efficiency Claimed for Modern High-Speed Gears

To the Editor of the ELECTRICAL WORLD:

The efficiency and life of modern gear units is a subject of very general interest and importance on account of the rapidly expanding use of such units in industrial motor application. In an article in the July 19 issue of ELECTRICAL WORLD, entitled "Selection of Motors in Rubber Mills," by C. E. Buchan, gear efficiency figures are presented which are not representative of modern practice. In discussing the relative merits of low-speed direct-connected and high-speed geared motors for mill drive the author of the article comments on gear efficiencies, saying, "It seems to be the consensus of opinion among rubber mill engineers that a 3 to 5 per cent decrease in efficiency is the minimum that can be expected."

Such efficiencies may have been true on some of the older and cruder types of open spur gearing with little or no lubrication, with inaccurately formed teeth and with inadequate plain bearings which could not maintain the gearing in accurate alignment. Modern high-grade single-reduction gear units when properly designed and applied can be expected to have a sustained efficiency of 99 per cent or better.

A typical illustration of the long life with high efficiency of this type of gear unit is seen in a sectional paper machine drive installation on the Pacific Coast. The nine motor gear units driving this high-speed news machine employ single helical gears totally inclosed with self-lubrication and equipped with roller bearings throughout. These units have been in continuous operation 24 hours per day, six days per week, for more than eight years and recent inspection has shown no detectable wear of gear or pinion teeth or of the roller bearings, although at least one of the units has carried more than its rated load most of the time. The fact that the temperature rise of these gear units is as low as ordinarily with the same load is further evidence that the efficiency has not decreased.

It might further be stated that most modern single-reduction gear units would not have sufficient area to get rid of the heat without dangerous temperature rise if the efficiencies were as low as those Mr. Buchan suggested.

As a concrete illustration of the relative efficiencies of low-speed direct-connected motors as compared with high-speed geared motors for rubber mill drive, a 250-hp. synchronous motor gear unit was recently applied in competition with a low-speed direct-connected synchronous motor. The guaranteed over-all efficiency of motor and gear unit combined was 91.5 per cent at full load, 91.3 per cent at three-quarter load and 90.7 per cent at half load, the efficiency of the gear unit alone averaging 99 per cent. This particular installation was referred to in the August *A.I.E.E. Journal* as follows:

> One rubber manufacturer installed the geared drive shown in Fig. 12 instead of the customary low-speed synchronous motor. The drive consists of high-speed synchronous motor and roller bearing helical gear built as a unit. It is interesting to note that the efficiency was 3.5 per cent higher than the low-speed motor and 40 per cent more starting torque was developed with the same kilovolt-ampere input.

S. A. STAEGE,
Industrial Engineer.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Men of the Industry

J. M. Costello New Vice-President in Syracuse

JOHN M. COSTELLO, general manager of the Syracuse Lighting Company, has, in addition, assumed the duties of vice-president. Beginning as superintendent of the Pulaski Electric Light Company in 1915, Mr. Costello has advanced in various executive positions with light and power companies of the state of New York. He was district manager of the Niagara, Lockport & Ontario Power Company, eastern division, from

1925 to 1928, and executive manager of the eastern territory from 1928 to 1930. Mr. Costello was assistant vice-president of the Buffalo, Niagara & Eastern Power Corporation until March of this year, when he was transferred to Syracuse as general manager of the Syracuse Lighting Company, Inc. He is also executive manager of the eastern division of the Niagara, Lockport & Ontario Power Corporation and a director of the Cortland County Traction Company.

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LEONARD W. PRESSON, for the past five years chief clerk of the new-business department of the United Electric Light Company, Springfield, Mass., has been appointed assistant manager following an association with the company that covers a period of thirteen years. Mr. Presson was born in Springfield in 1898. He entered the meter department of the United Electric Light Company in September, 1917, where he served his apprenticeship as a meter reader. Because of his tact and interest in customer relations, he was assigned to the new-business department in 1921 and for the past five years has been chief clerk of that department.

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ROY V. WRIGHT, managing editor of the *Railway Age*, has been elected president of the American Society of Mechanical Engineers. Mr. Wright has been identified with the industrial publishing field for a number of years.

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SAMUEL INSULL, chairman of the board of directors of the Commonwealth Edison Company, Chicago, returned from Europe September 26 aboard the Cunard liner *Aquitania* after a short sojourn abroad.

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COL. FREDERICK A. LIND has been appointed assistant secretary of the Electrical Credit Association. An experienced organizer and executive, Mr. Lind has practiced law in the city of Chicago since 1911.

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L. L. HILL, formerly with the Page & Hill Company of Minneapolis, is now executive vice-president of the Naugle Pole & Tie Company of Chicago. Mr. Hill has been for 27 years in the pole business and brings to his new connection a broad experience and a wide acquaintanceship.

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EDWARD T. KECK, who has been connected with the Texas Power & Light Company, Dallas, since 1918, has been appointed manager of engineering and power for that utility. A native of Savannah, Ga., he first was employed as a student engineer in the Savannah plant, which his father built. Here he spent five years in various departments, treasury, arc lamp and meter, commercial, street railway and power. He was transferred to the Baton Rouge Electric Company in 1911 and within a year was holding the position of chief engineer. Before affiliating himself with the Dallas utility he was at Port Arthur, Tex., with the Eastern Texas Electric Company and at Beaumont, where he had authority over the plant and the entire transmission system. His first connection with the Texas Power & Light Company was at Waco but in a year he was transferred to Dallas.

R. W. Mitchell Assumes New Executive Duties in Springfield

ROBERT W. MITCHELL, formerly assistant manager of the United Electric Light Company, Springfield, Mass., has been named general manager of that utility to succeed Sidney W. Stevens, who has become vice-president. A native of Brattleboro, Vt., Mr. Mitchell has been affiliated with the group now composing the Western Massachusetts Companies for the past twenty years. In 1901 he became associated with McIntyre

& Marshall, New York City, staying with this stock and bond house for four years. In 1906 he was associated with the National Light, Heat & Power Company of New York, being sent to the Twin State Gas & Electric Company, Brattleboro, Vt., as office manager, later becoming manager of the company. In 1910 he became associated with the Amherst Gas Company.

Mr. Mitchell is now vice-president of the Engineering Society of Western Massachusetts. He was secretary and treasurer of the western Massachusetts section of the A.S.M.E. for two years.

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H. L. DOOLITTLE, chief designing engineer of the Southern California Edison Company, Los Angeles, has been elected a manager of the American Society of Mechanical Engineers.

OBITUARY

Earl of Birkenhead

THE EARL OF BIRKENHEAD, formerly Frederick Edwin Smith, eminent lawyer and Member of Parliament, died at his home in London, September 30, at the age of 58. The Earl of Birkenhead was known to the public utility industry in this country as chairman of the board of the Greater London & Counties Trust, Ltd., which is the British subsidiary of the Utilities Power & Light Corporation, through which that American holding company acquired the ownership or control of a number of electric light and power companies in Great Britain. The Earl of Birkenhead regarded the settlement of the problems which arise in connection with the securing of cheap electricty and power as of first importance to England and its industries.

In the course of his illustrious parliamentary career he held the offices of Solicitor General, Attorney General, Secretary of State for India and Lord Chancellor. Tributes were paid to his memory by King George, David Lloyd George, Sir Austen Chamberlain, Prime Minister J. Ramsay MacDonald, Winston Churchill and other notable public figures in Great Britain.

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CHARLES J. MACNELLEY, for twenty years electrical engineer of the Panama Canal, died at his home in Nashua, N. H., September 20. He was born at Biddeford, Me., in 1873 and was educated at the Massachusetts Institute of Technology. For faithfulness to duty he was awarded the Roosevelt medal some years ago, and was retired on a pension in 1929.

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WILLIAM J. HENDERSON of New York died September 10, after a brief illness, in his forty-first year. Mr. Henderson was an accountant engaged in public practice as a consultant on public utility problems and was recognized as an authority on capitalization and regulatory matters. Prior to establishing his own practice in 1928 he was associated with H. C. Hopson for nine years. Earlier in his career he had been chief of the division of capitalization of the New York State Public Service Commission.

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WALTER S. MITCHELL, vice-president of the Mellon National Bank and a member of the board of directors of many public utility and industrial organizations, died, of pneumonia, September 25 in Pittsburgh. He was 73 years of age. Mr. Mitchell was a director of the Monongahela Light & Power Company, Monongahela Street Railway Company, Kensington Water Company and secretary and a director of the Kenilworth Land Company, Riter-Conley Company and the Union Shipbuilding Corporation.

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THORNTON L. HIGH, for the past year manager of the Pacific Electric Manufacturing Company's branch office in Portland, Ore., died suddenly in that city Sept. 3. Prior to his residence in Portland he had been employed by the Pacific Electric Manufacturing Company in the engineering department of its San Francisco office for six years.

•

PETER A. COGHLIN, one of the leading electrical contractor-dealers of central Massachusetts and a widely known business man of Worcester, died recently at Hendersonville, N. C., after a long illness. Mr. Coghlin was president and treasurer of the Economy Electric Company of Worcester. He was graduated from Worcester Polytechnic Institute, class of 1897.

•

FRANK E. GOOD, manager of the electrical department of the F. A. Clegg Company, contractor and dealer in electrical power installations, lighting fixtures, plumbing, heating, ventilating and electrical refrigeration, with offices in Louisville, Ky., died September 8 at St. Anthony's Hospital in that city. Mr. Good was born in Indiana, but at the age of 12 moved to Louisville, where he received his early education. He had been with the F. A. Clegg Company for nearly twenty years.

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R. C. W. LIBBEY, for the past four years in the range sales department of the Great Western Power Company, San Francisco, died in that city August 5. From about 1910 to January 1, 1924, Mr. Libbey was associated with the Simplex Electric Heating Company, Cambridge, Mass., and for the last four years of that time on the Pacific Coast. Following his resignation from the Simplex company he was appointed representative for Landers, Frary & Clark in the states of Montana, Idaho and Utah, a position which he held until he resigned in April, 1926.

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EDWARD GIBSON MACK, organizer and formerly managing director of the Canadian branch of the Crouse-Hinds Company, Syracuse, N. Y., died September 13 at his home in Toronto. Mr. Mack was born in Auburn, N. Y., March 19, 1887, and removed to Syracuse at an early age. He became associated with the Crouse-Hinds plant in 1902 and later entered the sales department. About 1910 he opened an office in Toronto, where he organized the Crouse-Hinds Company of Toronto, Ltd., which began operations in 1912. Mr. Mack was made managing director and served in that capacity until two years ago, when he resigned because of ill health. He also organized and became managing director of the Harvey-Hubbell Company, Ltd.

•

PERCY E. HART, prominent electrical engineer of Toronto, died, after a brief illness, on September 10 at the age of 60. Mr. Hart was born in England and removed to Canada when a boy, beginning his career as construction engineer with the Canadian General Electric Company. Afterward he joined the staff of the Toronto Hydro-Electric System and in 1913 was appointed chief engineer, a position which he held at time of his death. He was a fellow of the American Institute of Electrical Engineers and of the Canadian Institute of Engineers.

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FREDERICK D. PLATT, who was manufacturing superintendent of the motor department of the River Works of the General Electric Company at West Lynn, Mass., died, of pneumonia, at Moscow, U.S.S.R., September 21. Mr. Platt was there with other American engineers as an adviser in motor production. He entered the employ of the General Electric Company in 1899 as a draftsman at the River Works. He was later transferred to the engineering department and in 1919 was made manufacturing superintendent of the motor department. Mr. Platt was a member of the American Institute of Electrical Engineers and several other engineering organizations.

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EDWARD W. BEMIS, economist and consulting engineer for cities, states and public utility bodies, died September 25 in Springfield, Mo., in his seventy-first year. A graduate of Amherst College, Mr. Bemis conducted classes in political economy at Vanderbilt University, University of Chicago and the Kansas State Agricultural College. He served as director of the department of municipal monopolies, bureau of economic research, New York, and from 1901 to 1909 he was superintendent of the water department of Cleveland, Ohio. Returning to New York in 1910 he became deputy commissioner of water supply, gas and electricity. Since that time he had engaged in consulting engineering work. For ten years he was a member of the advisory board of the valuation bureau of the Interstate Commerce Commission. Mr. Bemis wrote extensively on municipal government, trade unions, trusts, monopolies, and other similar subjects.

Financial and Statistical News

DIVIDEND passing, a depression by-product, has been in evidence in many branches of industry. Its absence among utilities adds evidence of their inherent stability, already proved by the maintenance of earnings close to abnormally high 1929 totals. ——MARKET LIQUIDATION DURING THE YEAR just closed caused a shrinkage of more than five billion dollars in aggregate quoted values of leading utilities' stocks listed on the New York Stock Exchange.

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NEW CAPITAL ISSUES

ENGINEERS PUBLIC SERVICE COMPANY issued 75,000 shares of $6 cumulative dividend preferred stock at $100 and accrued dividend per share during the week ended October 2.

American States Public Service Company issued first lien 5½ per cent gold bonds, series A, at 89½ and accrued interest, to yield 6½ per cent. The original amount of this issue amounted to $2,130,000, but the present offering amounts to $819,600, the remainder of this offering having been already issued under the terms of the indenture. This new financing is in connection with the retirement of outstanding securities of subsidiary companies and the funding of obligations incurred by the company in the acquisition of new properties and through additions to and improvements and betterments of physical properties.

Super-Power Company of Illinois made an offering of an issue of first mortgage 4½ per cent bonds, the price being 96, to yield about 4.72 per cent. This piece of financing involved a total of $10,000,000.

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Canadian Output at Last Year's Level

CANADIAN CENTRAL ELECTRIC STATIONS had almost the identical output from water power, 1,392,858,000 kw.-hr., in July as in the corresponding month last year; including the small amount generated by fuel there was a gain of a fraction of a per cent, although a small decrease occurred relatively to the output in June.

Compared with last year Quebec gained 4 per cent, British Columbia the same, the Prairie Provinces 3, while Ontario lost 9 per cent. In the Maritime Provinces the output from water power was more than doubled.

Output figures as published by the Dominion Bureau of Statistics for recent months and for corresponding periods in other years, applying to the Dominion as a whole, are as follows:

Output in Thousands of Kw.-Hr.

Month	1930	1929	1928
May	1,535,623	1,456,687	1,280,811
June	1,424,449	1,378,124	1,242,324
July	1,414,539	1,410,709	1,248,365

British Electricity Output Up

THE LATEST OFFICIAL RETURNS rendered to the British Electricity Commissioners show that 721,000,000 kw.-hr. were generated by authorized undertakers in Britain during the month of August, 1930, as compared with 706,000,000 kw.-hr. in the corresponding month of 1929, or an increase of 2.1 per cent.

During the eight months of the year 1930, up to the end of August, the total amount generated by authorized undertakers was 6,888,000,000 kw.-hr., as compared with 6,536,000,000 kw.-hr. for the corresponding period of 1929, representing an increase of 5.4 per cent.

This materially exceeds the rate of increase reported for the same period by American public utilities, about 1 per cent.

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Carlisle Cites Obstacles to Government Ownership

ADOPTION of government ownership of the utilities in this country would not be so easy as many of its advocates would have us believe. Floyd L. Carlisle, chairman of the Niagara Hudson Power Corporation, pointed out some of the obstacles in addressing the Philadelphia Bond Club this week. What of the $400,000,000 tax bill, for example? Mr. Carlisle's remarks in part follow:

The question of government ownership of public utilities, with its political caste, is perhaps ever present, but is hardly a serious question, due to the lack of any real public sentiment for it and for other reasons which I will briefly discuss.

The first is the enormous capital requirements for the government or subdivisions of government entering into it. If the states or municipalities were to take over the existing gas and electric companies of the United States at values which the courts would determine in condemnation, I believe the sum would exceed that of the present national debt. The annual capital expenditures necessary to meet the growth of the companies is at least $1,000,000,000, which sum, of course, would have to be raised by bond issues. The advocates of government ownership are by no means clear themselves as to whether the federal government, state governments, cities, villages or towns should be the owners. The great hydro-electric resources of the country and the coal mines, the oil fields are not geographically located to be included in small groupings or territorial ownership.

Huge tax loss

The second insuperable handicap to government ownership lies in the amount of taxes paid by the companies and by stockholders of the companies which would be lost in the event of government ownership. During the year 1928 the total payment of taxes by public utility corporations made to all tax collecting agencies in the country, local, county, state and federal, amounted to $388,326,000. Of these taxes 46 per cent were contributed by the electric light and power companies, 25 per cent by the telephone and telegraph industry, 16 per cent by the electric railways and 13 per cent by the gas manufacturing industry. Since pre-war days taxes have increased twice as rapidly as revenue from consumers. In 1928 revenues were about three times as great as those in 1918, whereas taxes were five and one-half times as large. This rate of increase in public utility organizations is much greater than that of the steam railroads. In 1928 the taxes paid by the public utility companies equaled for the first time in history payments made by the railroads, although the revenues from the railroads are 36 per cent larger.

Considered in terms of net operating revenues, that is, gross revenues less the expenses of operation and maintenance,

public utility taxes absorbed 23 per cent during 1928. Expressed in other terms, out of every $5.35 available by the investor for the use of his money and for the increase of working capital the various agencies of the government took $1. Public utility taxes during the year 1928 could have furnished the entire tax levies of the cities of Boston, Philadelphia, Detroit and Chicago combined. They could have paid the entire expenses of the United States Navy and had enough left over to meet the deficit of the Post Office, or they could have made up the income taxes for all persons with an income of less than $100,000 per year.

Through income tax also

These figures which I have given relate solely to the taxes paid by the corporations themselves. In addition to that amount, while no exact figures are available, I believe that 50 per cent more comes to the government in the form of income taxes from individuals receiving bond interest and dividends, from profits arising in the sale of securities, from dues levied upon deceased estates owning such securities and from the varied forms of stock transfer taxes, registration fees, etc.

Our national and state governments more and more are relying upon income taxes with which to finance themselves. Obviously, government ownership would remove the latter form of tax income, that is, such amounts as are received from individuals and, of course, all forms of direct taxation in the hands of the governments taking them over.

The enormous capital investment which I have cited before in the problem of governments substituting new taxes in place of taxes lost is of such great weight that I do not think it necessary to discuss the question as to whether the government could operate the companies as cheaply and efficiently as they are under private ownership.

Electricity Lags Behind General Price Rise

WHILE the domestic user of electricity requires more current year by year, his electric bill takes only the same proportion of his income as was the case years ago, say Stone & Webster and Blodget, Inc. Their survey, which extends back to 1914, contends that the present-day electric customer spends less than two-thirds of the part of his income for current which he spent in 1914.

The study finds that the average yearly income of the wage earner and salaried man, regarded as typical of the domestic consumer, rose 117 per cent from 1914 to 1927, and the electric bill increased from $22.25 to $29.20, an advance of about 31 per cent.

More electricity used

But this is not the whole story, says the analysis, and it proceeds:

In order to render a full account of the benefits derived by the home users from the uninterrupted development of electricity and its various applications, it is necessary to give full weight to the constant increase in the average amount of kilowatt hours taken by the average residence customer.

From 268 kw.-hr. in 1914 the average has moved upward to 429 kw.-hr. in 1927 and 502 kw.-hr. in 1929. Consequently, the home user is not only spending a smaller proportion of his income, but for this smaller proportion he receives an amount of current 87 per cent larger than in 1914. If it had to be expressed in percentage of average income paid, it would be found that in 1927 the customer paid for each kilowatt hour only 36 per cent as much in proportion to his income as he did in 1914.

The growing number of appliances, the rapidly increasing electrification of farms, the insatiable demand for greater luxuries of lighting and other home conveniences, all such factors tend to a further and constant swelling of the domestic load and make additional economies possible, also, through interconnection of power systems.

Reduction of rates, therefore, may be considered a never-ending process, and there is evidence at present that the average domestic rate for a kilowatt-hour, which had sunk to a low of 6.18 cents in 1929 from 8.3 cents in 1914, will reach lower figures during the current and following years.

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Power Growth in Maritime Provinces

OUTPUT FIGURES FOR JULY for Canadian electric plants indicate that industrial activity has slowed down in Ontario, the Prairie Provinces and British Columbia. Quebec has reported a moderate increase, while the Maritime Provinces have made the greatest gains. The

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
American Water Works & Electric & Subs.					
(Year ended July 31)					
Gross earnings	$55,122,823	$52,520,469	4.9	50	50
Net earnings	27,443,079	25,965,049	5.7	..	..
Arkansas Power & Light					
(Year ended July 31)					
Gross earnings	8,877,684	7,853,497	13.0	53	52
Net earnings	4,172,189	3,812,223	9.0	..	..
Carolina Power & Light					
(Year ended July 31)					
Gross earnings	8,911,323	9,282,870	—4.0	45	45
Net earnings	4,911,579	5,062,701	—3.0	..	..
Cities Service					
(Year ended August 31)					
Gross earnings	59,109,386	39,885,688	48.2	..	..
Net earnings	57,110,650	38,657,916	47.7	..	..
Detroit Edison					
(Year ended August 31)					
Gross earnings	55,247,390	55,933,182	—1.2	67	65
Net earnings	17,972,065	19,286,818	—6.8	..	..
Federal Light & Traction & Subs.					
(Year ended July 31)					
Gross earnings	8,500,341	8,294,486	2.5	57	59
Net earnings	3,649,650	3,401,448	7.3	..	..
Houston Lighting & Power					
(Year ended July 31)					
Gross earnings	8,597,127	7,616,657	13.0	52	54
Net earnings	4,151,101	3,499,386	19.0	..	..
Idaho Power					
(Year ended July 31)					
Gross earnings	4,054,811	3,659,699	11.0	49	48
Net earnings	2,071,155	1,919,079	8.0	..	..
Kansas Gas & Electric					
(Year ended July 31)					
Gross earnings	6,069,838	5,593,976	9.0	53	53
Net earnings	2,873,029	2,626,129	9.0	..	..
Louisiana Power & Light					
(Year ended July 31)					
Gross earnings	5,880,827	4,682,271	26.0	52	52
Net earnings	2,824,676	2,239,046	26.0	..	..

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
Memphis Power & Light					
(Year ended July 31)					
Gross earnings	$6,710,980	$5,954,059	13.0	59	59
Net earnings	2,706,399	2,405,643	13.0	..	..
Minnesota Power & Light					
(Year ended July 31)					
Gross earnings	6,396,667	6,201,770	3.0	39	35
Net earnings	3,921,289	4,018,229	—2.0	..	..
Nebraska Power					
(Year ended July 31)					
Gross earnings	6,356,107	5,713,459	11.0	50	51
Net earnings	3,204,264	2,797,795	15.0	..	..
Pennsylvania Power & Light					
(Year ended July 31)					
Gross earnings	30,764,781	29,800,097	3.0	50	50
Net earnings	15,555,977	14,834,446	5.0	..	..
Pacific Power & Light					
(Year ended July 31)					
Gross earnings	4,566,928	4,774,855	—4.0	50	52
Net earnings	2,262,088	2,279,348	—1.0	..	..
Public Service Corporation of New Jersey & Subs.					
(Year ended August 31)					
Gross earnings	138,832,969	133,068,725	4.3	69	70
Net earnings*	42,792,885	40,447,712	5.8	..	..
Southern California Edison					
(Eight mos. ended August 31)					
Gross earnings	27,031,749	26,269,301	3.0	..	..
Net earnings	17,876,421	17,576,069	2.0	..	..
Texas Power & Light					
(Year ended July 31)					
Gross earnings	9,945,593	9,687,238	3.0	50	51
Net earnings	4,964,563	4,781,918	4.0	..	..
Utah Power & Light					
(Year ended July 31)					
Gross earnings	11,655,560	11,472,392	2.0	51	49
Net earnings	5,697,064	5,847,285	—3.0	..	..

*After operating expenses, maintenance, taxes and depreciation.

reason for the marked improvement in the Maritimes is largely attributable to the development of the pulp and paper industry in these provinces. Since the beginning of the year the Dalhousie, Mersey and Restigouche mills have been brought into operation. Dalhousie is taking around 30,000 hp., Fraser Company's Restigouche mill 20,000 hp. and Mersey Paper about 25,000 hp.

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Utilities in California Report Increased Revenues

A COMPILATION OF THE ANNUAL REPORTS filed by the 1,636 public utilities operating in California under the jurisdiction of the Railroad Commission, made by W. C. Fankhauser, financial expert of the commission, shows that these utilities had gross operating revenues during the calendar year ended December 31, 1929, amounting to $1,337,228,524 as compared with $1,283,972,219 during the year 1928, an increase of $53,256,305. A study of the operating revenues received by the public utilities from California business alone indicates that during 1929 they received from such business approximately $621,636,000. This indicates a substantial increase over the amount received during 1928 from California business, which was estimated by the commission's financial expert at $599,411,000.

The net operating revenues of the utilities aggregated $369,678,068 in 1929, as against $336,443,169 in 1928, or a gain of $33,324,899.

The number of public utilities of different kinds operating in California is as follows:

Steam railroads, operative 45, lessor 10; electric railways, operative 25, lessor 3; express companies 7; sleeping car companies 1; electric companies 45; gas companies 14; gas and electric companies 7; telephone and telegraph companies 132; water companies 385; warehouse companies (including cold storage) 367; wharfingers 22; carriers by water 76; auto stages and auto trucks 497.

Recent Listings

NEW YORK STOCK EXCHANGE has authorized the listing of 100,000 shares of $6 cumulative preference stock (no par value) of the Philadelphia Company on official notice of issuance in exchange for outstanding interim receipts. The New York Stock Exchange has also authorized the listing of 35,000 additional shares of class A stock (no par value) of the Utilities Power & Light Corporation on official notice of issuance and payment in full by sale to stockholders in lieu of cash dividend, making the total amount applied for 1,747,000 shares of class A stock.

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New Utility Offerings Total $1,000,000,000 in Nine Months

BOND, stock and note issues of the electric light and power companies of the country amounted to $1,124,191,934 during the first nine months of 1930, as compared with $767,135,000 during the similar period of 1929, an increase of 47 per cent. It is evident that the demand for this type of security still exists and funds are raised without difficulty.

To this substantial sum the month of September contributed $156,829,000, a figure which indicates a marked recovery over August, when the utilities entered the market to the amount of only $22,446,334. Among the sixteen separate issues there were only two offerings of preferred stock and one of notes, the remainder being bond offerings. High-grade bonds have come into their own again, it seems. The financing was of a long-term nature, only two short-term issues appearing. The average yield dropped to 5.09 per cent from 5.40 per cent in the preceding month.

New Security Issues of Electric Service Companies in September

Name of Company	Amount	Period (Years)	Class	Purpose	Interest Rate	Price	Per Cent Yield
Kansas City Power & Light Co.	$3,000,000	27	First mortgage gold bonds, series B	To reimburse for cost of permanent improvements, additions and betterments heretofore made, for the retirement of a purchase money mortgage and for other corporate purposes	4½	101	4.43
Portland General Electric Co.	40,000,000	30	First and refunding mortgage gold bonds	To retire debt now outstanding against the properties to be owned by the company, to refund advances for the installation of additional generating capacity, to provide company with working capital and for other corporate purposes	4½	93¾	4.90
Kentucky Utilities Co.	2,500,000	39	First mortgage gold bonds, series I	To reimburse for the cost of extensions and additions and for other corporate purposes	5	99¾	5.01
Electric Power & Light Corp.	15,000,000	100	Gold debentures	To retire current indebtedness, for working capital and for other corporate purposes	5	92½	5.40
	10,050,000	...	Cumulative preferred stock		6	100¼	5.95
Central Maine Power Co.	5,000,000	27	First and general mortgage gold bonds, series E	To reimburse for construction expenditures	4½	99½	4.53
Cumberland County Power & Light Co.	2,400,000	26	First mortgage gold bonds	To reimburse treasury for purchase of power sites and a steam generating plant	4½	95½	4.80
Sierra Pacific Power Co.	1,400,000	30	First mortgage and refunding gold bonds, series A	Discharge of obligations incurred for capital expenditures, retirement of present funded debt and other corporate purposes	5	95	5.34
Seaboard Public Service Co.	4,700,000	...	Convertible preferred stock		3½	47	6.9
Consumers Power Co.	20,000,000	28	First lien and unifying mortgage gold bonds	To reimburse in part for expenditures on additions and for other corporate purposes	4½	101½	4.40
Public Service Co. of New Hampshire	5,279,000	27	First and refunding mortgage gold bonds, series B	To retire securities of Manchester Traction Light & Power Company	4½	99	4.56
Continental Gas & Electric Corp.	16,000,000	28	Gold debentures, series A	To reduce current debt	5	92½	5.53
Tennessee Public Service Co.	7,000,000	40	First and refunding mortgage gold bonds	Acquisition of new properties	5	96½	5.20
Chicago District Electric Generating Corp.	15,000,000	40	First mortgage gold bonds, series A	Eefunding and other corporate purposes	4½	95	4.78
	8,000,000	5	Gold debentures		5½	100	5.50
Federal Public Service Corp.	1,500,000	2	Convertible gold notes	Acquisition of additional securities and for other corporate purposes	6	98¼	6.95
Total	$156,829,000			Rights, 14,557,972			
Total amount actually realized	$151,050,335			Total financing for September	$165,608,307		

Business News and Markets

General Cable Corporation Consolidates System

THE GENERAL CABLE CORPORATION began to be operated as one organization on October 1. All sales manufacturing and accounting activities now carried on independently and in the name of the separate divisions will be transacted only in the name of the General Cable Corporation. The separate divisions involved are:

A-A Wire Company.
American Insulated Wire & Cable Company.
Atlantic Insulated Wire & Cable Company.
Detroit Insulated Wire Company.
Dudlo Manufacturing Company.
Peerless Insulated Wire & Cable Company.
Philips Wire Company.
Rome Electrical Company.
Rome Wire Company.
Safety Cable Company.
Standard Underground Cable Company.
Southern States Cable Company.

It is stated by the company that the consolidation simplifies purchasing by providing one contact for all sales and sales service. It also greatly simplifies the accounting job.

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Electric Trucks for New York City

THE RAILWAY EXPRESS AGENCY'S recent order for electric trucks brings this company's electric truck fleet to 759 vehicles in the Metropolitan area of New York City. Since the first of the year the express company has ordered 50 additional 3½-ton electrics through its New York Office. The Railway Express Agency is the largest user of trucks in the world, and besides the electrics in service in New York operates more than 1,200 in other cities throughout the country.

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Westinghouse Orders

AN ORDER FOR TWO 196,000/230,000-volt oil circuit breakers, with a published interrupting rating of 2,500,000 kva., has been placed with the Westinghouse Electric & Manufacturing Company by the Southern California Edison Company, Los Angeles. These breakers are the type GO-2, 1,200 amp., three pole, electrically operated, and are for outdoor installation, it is announced.

Pacific Gas & Electric Company, San Francisco, has placed with the Westinghouse Electric & Manufacturing Company an order for two type GO-1 oil circuit breakers, rated at 1,200 amp. and 196/230 kv. with a published interrupting rating of 1,500,000 kva. at 230 kv. They are of the three-pole type, are electrically operated, and are for outdoor installation.

Carnegie Steel Company has ordered from the Westinghouse Electric & Manufacturing Company ten motors, including one 250 hp., two 600 hp., four 800 hp. and three 900 hp., two 2,000-kw. motor-generator sets and the control and speed matching equipment, all of which are for the operation of a new 10-in. bar, 12-stand mill, making both round and square bars from ⅜ in. to 1¼ in. thick.

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Grounds for Optimism in Electrical Business

SOME branches of the electrical industry show definite evidences of better business. G. A. Hughes, president of the Edison General Electric Appliance Company, Inc., writes the ELECTRICAL WORLD this week:

"As far as our business is concerned, we are enjoying the best that we have ever had, our orders and billing being ahead of 1929, to date. I believe that the depression which has affected business in general has touched bottom, and things are improving. I do not look for a quick return, but I do think that 1931 will be better than 1930, and 1932 will show a decided improvement over 1931."

Gen. Otto H. Falk, president of Allis-Chalmers Manufacturing Company, writes:

"Business with us continues on a low basis, but there appear to be some indications which point to improvement in the near future. While we cannot say that new orders are on an increased rate at the present time, we are hopeful, and feel that we have some ground for a belief that there will be some marked improvement along these lines during the fall and early winter."

General Electric Company's operations for the third quarter have been on a steady basis, with some lines showing a slight recession compared with last year. The company is beginning to benefit from the sale of radio receiving sets, although reflection of a material volume of business for the last quarter from that division is unlikely.

An upturn has taken place in the railroad electrification business, with indications that a greater volume of business will be forthcoming in the near future. The same is true with regard to central-station buying in practically all sections of the country.

Some improvement in general business activity continues to be evident both in the statistics and in trade reports. The latter indicate a definite improvement in retail purchasing in spite of unfavorable weather. Steel production is showing slightly more than the usual seasonal increase in spite of slack automotive and railroad steel demand. Among all the indicators, building is making the most encouraging showing, with a marked pick-up in residential building in September. Electric power production as well as merchandise carloadings have increased so far at somewhat less than the usual seasonal rate. Indications are that employment and industrial activity generally during September have improved, but less than seasonally.

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Electric Clock Manufacturers Unite

A REVIVAL OF THE CLOCK BUSINESS, which is expected to develop into a billion-dollar market, was forecast by an announcement of R. H. Whitehead, president of the New Haven Clock Company, to the effect that his organization has just reached a very satisfactory business arrangement with the Westinghouse Electric & Manufac-

turing Company. Both these organizations will shortly offer to the public the New Haven-Westinghouse electric clock. An average of four clocks to a home represents a rapidly growing market of more than 75,000,000 clocks, says the statement.

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Standard Gas System Boosts Merchandise Sales

SUBSTANTIAL INCREASES WERE MADE in merchandise sales by properties of the Standard Gas & Electric Company system for the first six months of 1930.

Gross sales for the six-month period ended June 30, 1930, amounted to $3,550,404, an increase of 7.29 per cent over the corresponding period of 1929. The total number of electric appliances sold shows an increase in all classes of appliances with the exception of small heating units, portable lamps and lighting equipment. The total number of gas appliances sold during the six-month period, however, shows a slight decrease.

TRADE BRIEFS

Roller-Smith Company announces the appointment of J. K. Webb to the position of district sales agent for the state of Texas with offices in Dallas.

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A district office has been opened in Pittsburgh by the Moloney Electric Company of St. Louis with headquarters in the Standard Life Building. R. M. Casper, formerly connected with the Public Service Corporation of New Jersey, has been named district manager.

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Robbins & Myers Sales, Inc., Springfield, Ohio, manufacturer of electric fans, motors, household appliances, and material-handling equipment, announces the appointment of W. R. Davis as manager of its eastern district, succeeding C. A. Stirling, recently resigned.

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Coppus Engineering Corporation, Worcester, Mass., announces the appointment of Martin Van Stappen as sales manager of the industrial blowers and turbine department. Ernest Kundig has been named sales manager of the house-heating blower department as well as export manager.

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Clark Controller Company of Cleveland has acquired control of the Sundh Electric Company of Newark, N. J., through the purchase of common stock. Operation will continue under the name of Sundh Electric Company.

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The Philadelphia sales office of Cutler-Hammer, Inc., has been changed to the tenth floor of the new Terminal Commerce Building, 401 North Broad Street, effective September 29. F. J. Burd is in charge of the Philadelphia district.

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New York Metal Prices

	Sept. 24, 1930 Cents per Pound	Oct. 1, 1930 Cents per Pound
Copper, electrolytic	10¼–10⅜	10
Lead, Am. S. & R. price	5¼	5.35
Antimony	7.70	7¼
Nickel, ingot	35	35
Zinc, spots	4.60	4.60
Tin, straits	29⅛	28
Aluminum, 99 per cent.	23.30	23.30

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EXPORTS OF ELECTRICAL EQUIPMENT (PRELIMINARY)

Article	July 1929	July 1930
Generators:		
Direct current—		
Under 500 kw	137,435	29,592
500 kw. and over	6,000	138,197
Alternating current:		
Under 2,000 kva	42,675	21,086
2,000 kva. and over	71,032	.....
Steam turbo generator sets	75,957	188,541
Accessories and parts for generators	72,877	76,045
Arc welding sets	.....	33,095
Self-contained lighting outfits	96,866	52,542
Batteries:		
Storage batteries	254,020	.....
6-volt storage batteries	.....	160,075
Other storage batteries	.....	94,102
No. 6 dry cell batteries	.....	48,906
Flashlight batteries	211,591	227,086
Radio B and C batteries (dry)	77,698	56,680
Other dry and wet cell primary batteries	148,919	16,781
Transforming or converting apparatus:		
Power transformers, 500 kva. and over	290,020	156,981
Distribution transformers, less than 500 kva	72,418	130,375
Instrument transformers	11,276	21,009
Other transformers	86,565	80,167
Complete battery chargers under 15 amperes	19,736	11,561
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	102,249	27,328
Transmission and distribution apparatus:		
Switchboard panels, except telephone	64,485	100,060
Switches and circuit breakers over 10 amp.	155,509	161,512
Fuses	38,036	30,230
Watt-hour and other measuring meters	88,497	65,661
Electrical indicating instruments	74,606	64,566
Electrical recording instruments	44,883	26,687
Other electrical testing apparatus	99,946	84,887
Lightning arresters, choke coils, reactors, and other protective devices	43,765	54,983
Motors, starters, and controllers:		
Motors, ¼ h.p. and under	240,163	247,341
Motors, over ¼ and under 1 h.p.	66,356	73,117
Stationary motors—		
1 to 200 h.p.	449,585	194,104
Over 200 h.p.	39,813	41,069
Railway motors	49,815	2,512
Electric locomotives—		
Railway	67,992	14,415
Mining and industrial	53,111	39,444
Station and warehouse motor trucks	16,439	33,583
Starting and controlling equipment—		
For industrial motors	159,937	159,837
For electric railway and vehicle motors	6,759	13,091
Portable electric tools	149,344	127,063
Accessories and parts for motors	320,679	181,514
Refrigeration sets up to ¼ ton capacity	1,020,891	.....
Refrigeration sets over ¼ to 1 ton cap.	165,655	.....
Electric household refrigerators	.....	581,460
Electric commercial refrigerators up to 1 ton	.....	156,160
Thermodynamic refrigerators	.....	1,118
Electric appliances:		
Electric fans	88,301	55,872
Electromechanical health exercisers	.....	9,166
Electric incandescent light bulbs—		
Metal filament	97,035	.....
For automobiles, flashlights, and Christmas trees	.....	14,241
Other metal filament bulbs	.....	77,004
Other electric lamp bulbs	61,637	11,004
Flashlight cases	210,211	93,961
Searchlight and floodlights	47,057	48,891
Motor-driven household devices—		
Electric household washing machines	176,326	99,251
Electric vacuum cleaners	165,469	139,101
Other motor-driven devices, except tools	93,255	96,931
Electric flatirons	34,865	15,137
Electric cooking ranges	35,579	22,010
Other domestic heating and cooking devices	76,448	64,010
Industrial electric furnaces and ovens	59,769	33,663
Therapeutic and x-ray apparatus	158,924	103,124
Signal and communication devices:		
Radio apparatus—		
Transmitting tubes, sets, and parts	121,095	36,021
Receiving sets	767,394	781,663
Radio receiving tubes	138,440	167,685
Receiving-set components	369,013	322,314
Loudspeakers	185,675	113,793
Other receiving-set accessories	205,725	81,051
Telegraph apparatus	103,881	78,565
Telephone apparatus—		
Telephone instruments	119,016	26,207
Telephone switchboards	83,105	119,056
Other telephone equipment	413,063	232,858
Bells, buzzers, annunciators and alarms	27,064	21,777
Other electric apparatus:		
Spark plugs	198,632	135,429
Other starting, lighting, and ignition equipment	136,811	86,709
Insulating material	178,412	78,923
Metal conduit, outlet and switchboxes	136,931	77,282
Sockets, outlets, fuse blocks, and lighting switches	168,499	148,292
Electric interior lighting fixtures	217,686	126,869
Electric street lighting fixtures	56,264	42,604
Other wiring supplies and line material	119,228	127,243
Other electrical apparatus, n.e.s.	1,197,243	936,768
Rubber and friction tape	45,565	36,421
Globes and shades for lighting fixtures	62,936	41,373
Glass electric insulators	25,935	9,086
Electrical Porcelain:		
For less than 6,600 volts	61,027	33,843
For 6,000 volts and over	38,935	37,191
Carbons and electrodes:		
Electrodes for electric furnaces	127,814	122,627
Other carbon products	76,211	53,131
Insulated iron or steel wire and cable	21,371	8,436
Copper, bare wire	308,379	173,487
Insulated copper wire and cable	504,612	.....
Rubber covered wire	.....	62,887
Weatherproof wire	.....	43,096
Telephone	.....	23,806
Other insulated copper wire	.....	225,933
Totals	$12,714,438	$9,550,395
Seven months ended July 31	$83,029,437	$81,218,625

Market Conditions

THE third quarter, just closed, has been generally disappointing. Hopes of recovery have not yet been borne out substantially. Day-to-day buying is at a low level. Construction is active on the Pacific Coast, but central-station buying is limited.

——PRICE STABILITY IN THE EASTERN DISTRICT makes for large buying by the utilities, but most of it is still in prospect.

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EASTERN

—WITH THE CLOSE OF SEPTEMBER, *the electrical equipment market in the Eastern district terminates a month of rather general disappointment to the trade. The first half of the month was better than the concluding days, and while October opens up with certain optimism, the immediate business in sight is not any too encouraging.*

—INQUIRIES BOTH FOR *central station and industrial equipment continue to develop, but the time of maturity for worth-while account continues indefinite. The existence of a real buyers' market is most pronounced as the fall season expands; price stability, however, is making for an improved situation, and one where ultimate purchases seem quite conclusive at close to present levels.*

A Philadelphia manufacturer has closed for Diesel engine generating equipment for a municipal installation in Michigan, approximating $100,000. A municipality in Missouri has awarded contracts for power station equipment to an amount of $100,000, a sizable portion of the order going to a New York producer. A feature of the week is the proposed development of electric clock manufacture by the Westinghouse Electric & Manufacturing Company and the New Haven Clock Company, and orders for 150,000 such units, costing about $900,000, have been secured up to the present time, with prospects excellent for considerable increase. The clocks will be primarily for domestic service. Production is now on a basis of 2,500 clocks daily, with early advance to 3,000 per day anticipated.

Industrial demand is still centered in basic branches of activity, with iron and steel, metal-working, oil refining and chemical leading all other lines. A motor manufacturer in Michigan has just recorded the largest order for units of various sizes in the history of the plant. Another maker of electric motors in Ohio is developing increased output under encouraging account. The Great Lakes Steel Company will build an addition to its mill at Ecorse, Mich., to cost over $500,000, and will install heavy mill motor drives for a 14-in. merchant mill. The Jones & Laughlin Steel Company will expend over $8,000,000 in an expansion program at its Pittsburgh mill.

CONSTRUCTION PROJECTS

State Department of Public Works, Albany, N. Y., plans power plant to cost $450,000, and machine shop and trade mechanical building at Auburn Prison to cost $400,000. General Electric Company, Schenectady, N. Y., will build addition to plant of subsidiary, Cleveland Wire Works Division, Cleveland, Ohio, to cost $400,000. Kent Automatic Garages, Inc., New York, plans commercial garage and repair shop at Philadelphia, Pa., to cost $2,000,000. Board of Education, New York, contemplates boys' industrial high school at Brooklyn, to cost $1,600,000. Board of City Commissioners, Jersey City, N. J., will receive bids until October 7 for addition to power plant. Philadelphia & Reading Coal & Iron Company, Philadelphia, Pa., plans central coal breaker in vicinity of St. Nicholas, Pa., to cost over $2,000,000. Chestnut Farms Dairy, Inc., Washington, D. C., contemplates plant at Baltimore, Md., to cost $500,000. General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until October 15 for magnet wire, resistance units, sockets, flashlights and other electrical supplies (Panama Schedule 2594). Bureau of Supplies and Accounts, Navy Department, Washington, D. C., is asking bids until October 7 for turbo-generator sets and spare parts (Schedule 4061.)

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SOUTHEAST

—SALES ARE AT ABOUT THE SAME LEVEL *as for the past few weeks, but a slight improvement is noted in the industrial situation. Central-station purchases continue on a hand-to-mouth basis.*

A Georgia power company ordered regulators amounting to $14,000, while a southern Florida company ordered similar equipment to the extent of $5,000. The city of Jacksonville ordered meters totaling approximately $15,000. Other central-station orders reported were for $6,000 worth of disconnect switches and $3,000 of small power and distribution transformers. A paper mill in Florida placed an order for control equipment amounting to $34,000 and a textile mill in South Carolina purchased motors totaling $3,000.

A new office building in Atlanta purchased lighting fixtures costing $6,000 and $1,000 in lighting fixtures were ordered on the remodeling job of the Georgia State Capitol. A municipality in middle Georgia ordered $1,500 in wiring materials.

CONSTRUCTION PROJECTS

West Virginia Rail Company, Huntington, W. Va., plans addition to mill to cost $200,000. Department of Commerce, Washington, D. C., plans call for bids for radio beacon stations in vicinity of Louisville, Ky. Southern Coal & Coke Company, Knoxville, Tenn., plans extensions and improvements in coal mining plant, including tipple, to cost about $130,000. Exposition Cotton Mills, Atlanta, Ga., plans addition to cost $85,000.

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MIDDLE WEST

—BUSINESS IN THE MIDDLE WEST *section appears to have turned the corner and industrial activity seems to be increasing. However, the indications of improvement are not yet sufficiently defined to justify confidence in their duration. For the past few weeks more than seasonal activity has been noted.*

—INCREASING ACTIVITY IN MOST *of the basic lines justifies the hope that the lowest point of the depression has been passed. Increased carloadings, together with the continued rate of steel and automotive production, are looked upon as favorable indications.*

The various utility companies are proceeding carefully with their fall construction programs, while more circuit revision work is being started. There has been a limited demand for apparatus with a good demand for distribution equipment.

Jobbers' sales are somewhat better. There has been a good demand for most appliances, particularly of the cool morning type.

CONSTRUCTION PROJECTS

Baraga County Light & Power Company, Baraga, Mich., plans power dam and electric plant on Sturgeon River. Detroit Edison Company, Detroit, Mich., has plans for addition to steam-operated electric power plant to cost over $1,000,000. Detroit (Mich.) Public Lighting Commission has plans for a power substation. Wyandotte, Mich., will ask bids in 30 days for municipal power plant to cost $300,000. American Steel & Wire Company, Cleveland, Ohio, will build mill addition to cost $1,500,000. Central West Public Service Company, Omaha, Neb., plans addition to power plant at Westhope, N. D., to cost over $100,000. Devil's Lake, N. D., contemplates ornamental lighting system. Northfield, Minn., contemplates municipal electric light and power plant. Thief River

Falls, Minn., has voted bonds for a municipal power plant to cost $80,000. General Minnesota Utilities Company, Pine City, Minn., plans transmission line at Funkley, Minn., and vicinity. G. A. Roth Manufacturing Company, Hastings, Neb., plans addition to automobile accessory plant to cost $85,000. Denison, Iowa, plans installation of additional equipment at municipal electric power plant. Iowa Power & Light Company, Des Moines, Iowa, contemplates transmission line in Mahaska County.

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PACIFIC COAST

—RETAIL BUSINESS HAS SLUMPED *a bit with the market drop, but building construction is really improving, especially in suburban tracts, where contractors are working fair-sized crews on small residences.*

—STATE AND GOVERNMENT BUYING *is good, but power, railroad and industrial purchasing is only fair despite a few outstanding orders.*

One power company is reported to be working 150 draughtsmen on conversion and standardization of properties recently taken over and on new projects, so that 1931 is expected to be a banner year for central station ordering. Hawaiian Island buying is good, including large assorted orders for wiring supplies, complete relighting equipment for a pineapple plant and a $15,000 General Electric waterwheel generator and control equipment. Municipal purchasing is also good, including $20,000 worth of Westinghouse transformer coils to be used in rebuilding equipment for Los Angeles, a $3,000 General Electric voltage regulator for the city of Ukiah, a $5,231 street-lighting award for Gustine electric ranges and a clock system for the Los Angeles general hospital and a $1,000,000 city and county building for San Diego. Los Angeles will vote in November on a $13,000,000 bond issue for its own valley plant and power system and San Francisco is to call for bids on 300 concrete and 610 metal standards estimated to cost $160,000 for boulevard lighting.

Activity of municipal light and power plants in Seattle and Tacoma last week included opening of bids by Board of Contracts and Awards—Tacoma for two used 40 to 50-ton, 600-volt standard gage electric locomotives costing about $60,000 and for a year's supply of small station and distribution transformers costing between $60,000 and $70,000, original bids for the latter having been rejected. City of Seattle bought $20,000 worth of transformers, ranging from 5 to 100 kw. for local distribution, and city of Tacoma six motors costing about $1,000 for steam auxiliary unit. City of Seattle on October 10 will open bids for excitation and regulation equipment for Lake Union steam auxiliary costing about $15,000, having rejected original bids. Motor orders reported include 30 machines with control apparatus for lumber mill in Seattle involving about $9,000, twenty machines from 25 hp. down to agricultural dealers and 40 machines from 100 hp. down to mills, allied industrials and miscellaneous sources. National Pole Treating Company of Minneapolis bought $40,000 worth of red cedar poles from Studebaker Pole Company, Seattle, and shipment has been made.

CONSTRUCTION PROJECTS

Pacific Gas & Electric Company, San Francisco, Calif., plans hydro-electric power plant on Battle Creek, Shasta County, with initial capacity of 20,000 hp. Board of Regents, University of California, Berkeley, will receive bids until October 17 for an electrical distributing system. San Leandro, Los Angeles, Petaluma and San Rafael plan ornamental lighting systems. Puget Sound Power & Light Company, Seattle, Wash., plans extensions in transmission lines and addition to substation at Bellingham, Wash., to cost $70,000. Soda Springs, Idaho, plans municipal hydro-electric power plant. Rocky Mountain Refinery, Inc., Pueblo, Colo., plans oil refinery to cost $100,000.

Low Prices Induce Utility Buying

FURTHER EQUIPMENT BUYING by the utilities is recorded this week. Frank T. Hulswit, head of the Commonwealths Power Corporation, states his company has decided to inaugurate a policy of immediate buying for near future needs. This decision was reached, Mr. Hulswit says, after a study of prevailing prices of commodities and equipment needed. These prices are too attractive in relation to past prices to overlook, says the statement, and are not likely to go lower. "Therefore we look for an increase in prices sufficient to warrant our investment in materials in advance of our further operating and construction requirements."

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SOUTHWEST

—THE FEELING AMONG MANUFACTURERS, *while expressions are in all cases conservative, is distinctly better. Line material has been moving out in better volume. There is the normal seasonal demand for radio apparatus and more activity among industrial buying motors and transformers in the stock sizes.*

An order was placed for an outdoor substation equipment with circuit breakers and lightning arresters amounting to $40,000. Contracts were let for generator voltage regulators costing $11,000 and switchboard material $22,000 for one of the Missouri hydro-electric plants now under construction. A carload of anchors aggregating $5,000 for an Iowa power company and a shipment of line material costing $6,000 to a Missouri company are also reported.

CONSTRUCTION PROJECTS

Thayer, Mo., plans a municipal electric light and power plant. Flexwood Company, Chicago, Ill., plans veneer mill at St. Louis, Mo., to cost $200,000. Board of Education, St. Louis, Mo., has filed plans for shop and equipment building to cost $175,000. Sikeston, Mo., has approved plans for a municipal electric light and power plant to cost $150,000. Pickwick-Greyhound Company, Tulsa, Okla., plans bus terminal and shop, with hotel, to cost $750,000. Lubbock, Tex., plans ornamental street-lighting system. Col-Tex Refining Company, Colorado, Tex., will make extensions and improvements in oil refinery to cost $100,000. Central Power & Light Company, San Antonio, Tex., plans hydro-electric power plant on Guadalupe River, near Thomaston, Tex.

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NEW ENGLAND

—DURING THE PAST WEEK ORDERS *for heavy electrical equipment declined and little activity is reported. Negotiations for heavy power equipment are confined to engineering studies of a number of projects as yet advanced only to the preliminary stages.*

—ORDERS WERE PLACED *for large motors for special uses, including pumping and printing machinery drive. Two institutions are considering additions of a few motors for demonstration purposes. Small motor sales and control equipment orders are steady but in less volume than last year.*

Due to uncertainty among machine tool manufacturers, the seasonal demand for fractional-horsepower motors is less brisk than at this time last year, although one manufacturer reports an encouraging demand, with orders from oil-burning equipment manufacturers outstanding.

Central-station equipment sales are dull; wire and poles for line extensions are moving fairly well and one manufacturer reports small lot sales of insulators are being received regularly. On the other hand, substation needs are closed up in general and the trend is spotty.

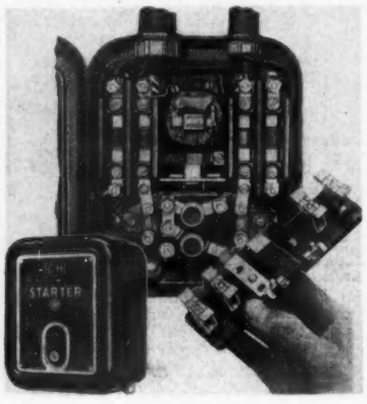
CONSTRUCTION PROJECTS

Boston & Maine Railroad Company, Boston, Mass., plans extensions and improvements in car shops at Concord, N. H., to cost over $300,000. Simonds Saw & Steel Company, Fitchburg, Mass., has approved plans for immediate construction of plant to cost $1,500,000. American Coal Company, Boston, Mass., contemplates storage and distributing plant to cost about $60,000.

New Equipment Available

Small Motor Starter with Magnetic Contactor

AUTOMATIC STARTERS FOR SMALL a.c. motors incorporating a newly developed "twin break" magnetic contactor are announced by Cutler-Hammer, Inc., Milwaukee, Wis. The "twin break" principle reduces the arc voltage by half, and "Thermoplax" arc pockets,



which reduce the air content around the contacts, prevent the formation of a destructive arc, according to the manufacturer.

The contact points of the magnetic contactor are of heavy coin-silver, which retains its current-carrying capacity even if oxidized, and always makes a good contact with little temperature rise. A magnetic latch has been added to prevent accidental closure of the contacts in case the starter is accidentally bumped or tilted.

These new contacts are made in three- and four-pole types. The maximum ratings for two or three phase are 3 hp., 110 volts; 5 hp., 220 volts, and 7½ hp., 440 or 550 volts.

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Thermometer Records Temperatures in Ducts

DUCT-RECORDING THERMOMETERS comprising a flexible steel fish wire terminated by a tiny hardened steel case inclosing a 0 to 100 deg. C. thermometer have recently been placed on the market by the Cable Accessories Corporation, Pittsburgh, Pa. These thermometers are so constructed that they can easily be thrust between the cable and the duct wall to a depth of 8 to 10 ft., where the actual cable sheath and duct air temperatures are recorded.

An interval of fifteen minutes is necessary to permit the thermometer to reach its full reading. In duct lines having a heavy load cycle the recorder may be left in place for 24 hours, in order to record the peak temperatures.

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Solderless Connectors Do Not Require Tools

SOLDERLESS LINE CONNECTORS which require no tools for installing have recently been placed on the market by the Solderless Connector Company, Chicago. This device comprises a double-tapered, hard copper shell, two three-piece sets of wedges and a non-rusting coiled compression spring. The three-piece sets of wedges are held in position in the tapered ends of the copper shell by the spring.

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Large Portable Motors for Heavy Power Jobs

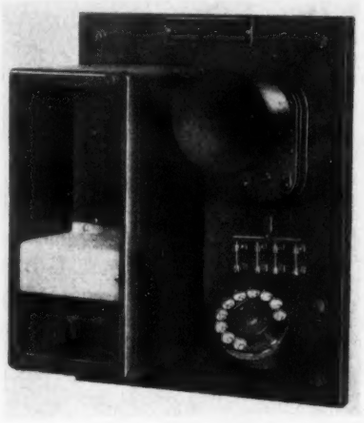
PORTABLE MOTORS which can be readily transported from place to place, firmly set into position and quickly belted to various machines are announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh. A single stake driven through an eye-bolt at the end of the tongue holds the unit in position, and the slack in the belt is taken up by means of a jack arrangement which operates on a telescoping tongue. Increments of ¼ in. are available for belt adjustment, and the belt tension may be changed when the motor is operating.

Extra pulleys are provided to obtain the correct speeds for the various

machines, and 40 ft. of cable is furnished to connect the unit to a power receptable. The motor starter is provided with overload and no-voltage protection.

Audio-Frequency Control for Automatic Machinery

EQUIPMENT FOR CONTROLLING THE OPERATION of remote automatic electric machinery by means of audio-frequency impulses is announced by the General Electric Company, Schenectady, N. Y. With this apparatus indications of



electrical conditions from the remote equipment are given by means of audible signals, in contrast to previous methods using visual indications.

This control equipment is applicable to the operation of various types of electric machinery. Automatic hydro-electric generating plants in central station systems, automatic pumping stations, etc., may be controlled from a remote point. The operator, at a point distant from the devices he controls, can open and close valves and circuit breakers, start and stop pumps, etc. He receives automatic indications of the position of the valve gates, of whether the pumps are running or stopped, of hot bearings, gasket blow-outs, oil level drops, pressure drops, etc.

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Totally Inclosed Motor with Easy Accessibility

TOTALLY INCLOSED, FAN-COOLED MOTORS having simplicity, compactness, accessibility and strength are announced by the Allis-Chalmers Manufacturing Company, Norwood, Ohio. The ends of these motors are sealed by a one-piece casting which serves as a bearing housing and end closure. The stator and frames are of double-deck construction, with the inner deck machined to form a long rabbet fit with the combination bearing housing end closure, thereby sealing the stator windings and rotor against the entrance of dust, fumes, moisture and similar destructive agents. The anti-friction bearings are mounted in self-contained cartridges.